A Study
of some
Clinical and Pathological Aspects
of
Scarlet Fever

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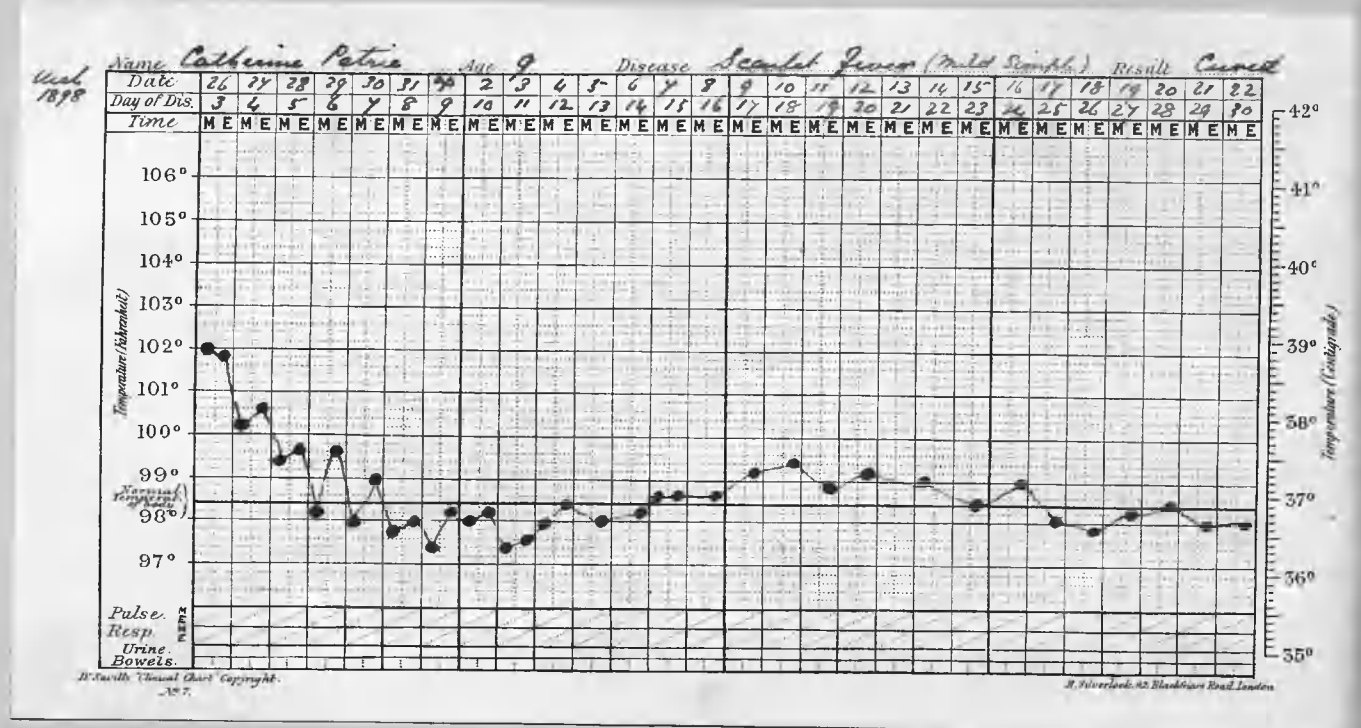
Contents.

Scarlet Fever is one of those diseases which to a superficial glance presents comparatively few elements of surpassing interest, partly on account of the great similarity which the majority of mild cases exhibit, and partly on account of the absence of distinctive lesions in the disease, and our ignorance regarding its true nature. The subject, however, is one which of late years has received a large amount of attention, and the enquiry into its Etiology may be considered one of the most important Bacteriological quests of the day. The widespread occurrence of Scarlet fever, its great infectiousness, and its frequently fatal developments, render it an object of dread to the general public; while the helplessness of the Physician when face to face with its severer manifestations is a very painful consideration. Whether we are on the Eve of some discovery which will both clear up the obscure question of the real origin of the disease, and pave the way for new methods of treatment, remains still to be proved. In the meantime, it must be admitted that much of our knowledge regarding its nature is of a purely Speculative character. A more minute examination of the phenomena of the disease opens out many problems of great general importance, for the solution of which we must patiently wait upon the Evolution, especially of bacteriological Science. In this paper no more will be attempted than to give a brief survey of some present day literature on the subject, with the object of marking the Progress which has already been made in elucidating the pathology of the disease, and of indicating certain points of interest to the Practical Physician, suggested by the results of recent research.

It will be necessary, however, to give first of all a Sketch of the main phenomena of the disease, as exhibited in an interesting series of representative cases which recently came under my own personal observation.

Case 2


Name Catherine Petrie
Age 9
Disease Scarlet Fever (Mild Simple form)
Result Cured
March 1898
Date
Day of Dis.
Time
Temperature (Fahrenheit)
Temperature (Centigrade)
Normal Temperature
Pulse
Resp
Urine
Bowels
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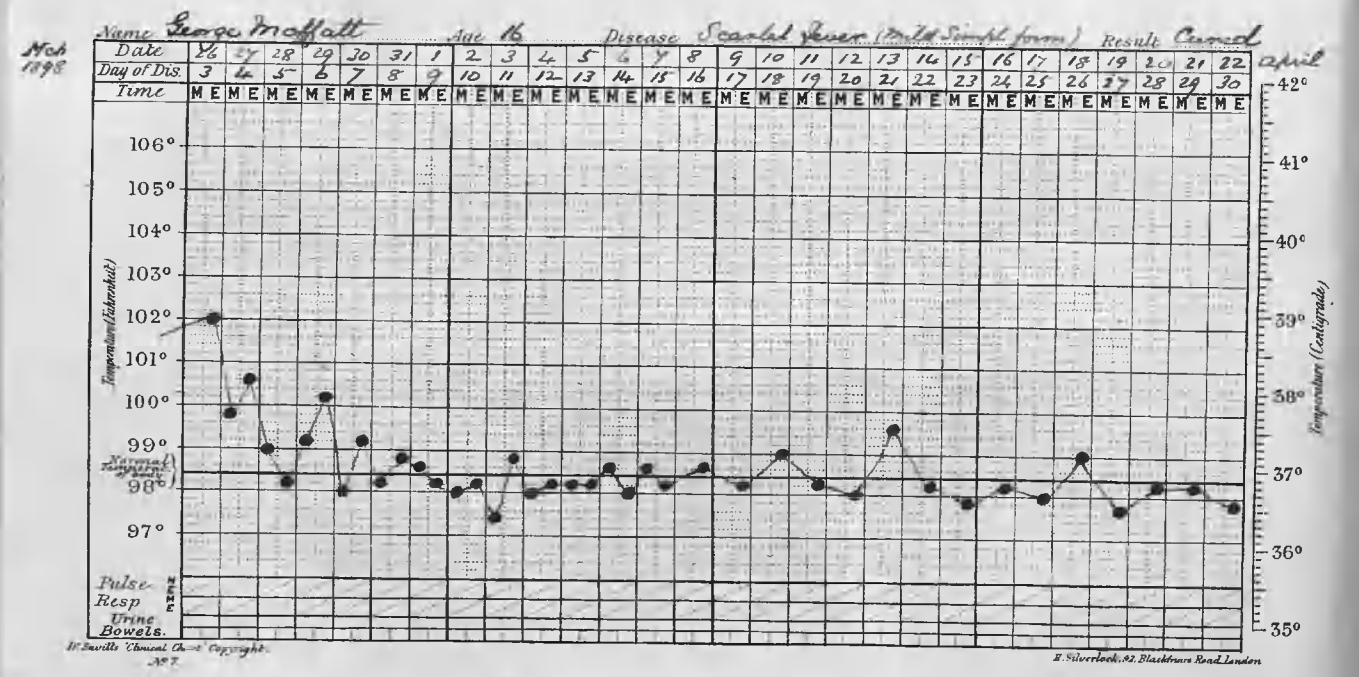
Name George Moffatt
Age 16
Disease Scarlet Fever (Mild Simple form)
Result Cured
March 1898
April
Date
Day of Dis.
Time
Temperature (Fahrenheit)
Temperature (Centigrade)
Normal Temperature
Pulse
Resp
Urine
Bowels
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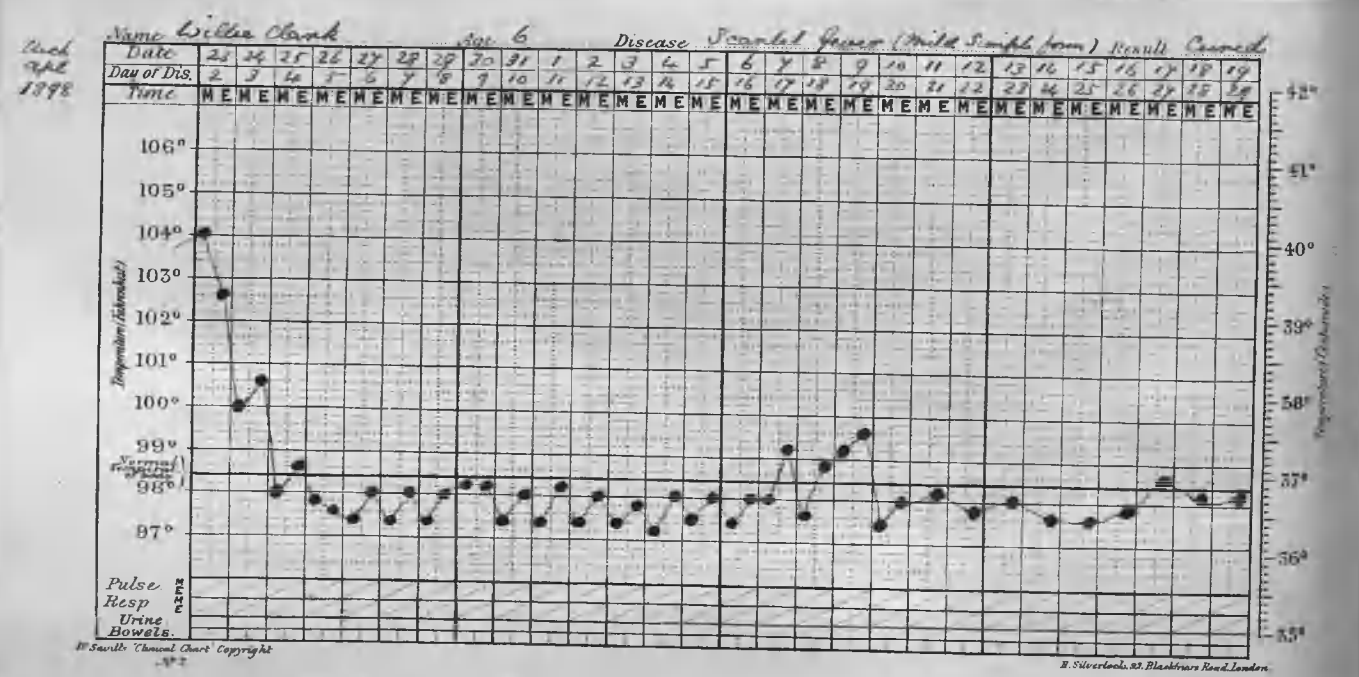
Name Willie Clark
Age 6
Disease Scarlet Fever (Mild Simple form)
Result Cured
March April 1898
Date
Day of Dis.
Time
Temperature (Fahrenheit)
Temperature (Centigrade)
Normal Temperature
Pulse
Resp
Urine
Bowels
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Case Records:-

There are few diseases which exhibit greater diversities in Severity than Scarlet Fever. In this respect whole epidemics, lasting it may be for months, may show the greatest mildness of type, while at other times the disease becomes a perfect Scourge, carrying hundreds of children to an untimely grave.* On the other hand, some epidemics are characterised by the occurrence of a mixture of mild and severe cases in varying proportions; and it is particularly worthy of note that in the midst of a run of apparently trivial attacks the disease may suddenly manifest itself in its most virulent and deadly form, taking the unwary physician quite by surprise. In the wards of a Fever hospital it is usually possible to study all types of the disease, except perhaps the very mildest, which are often only sent in during the stage of desquamation, the acute stage having been so insignificant as to have escaped notice. During the year 1897 and the greater part of 1898, while acting as Resident Medical officer in the County & City of Perth Royal Infirmary, a succession of 257 cases came under my personal observation, there being at that time an extensive epidemic prevailing in the Town & County of Perth. As the Epidemic was one of medium severity, these cases included examples of nearly all the varied manifestations of the disease. The wards of the Infirmary set apart for Scarlet Fever only admitted of forty patients being treated at one time, but this number afforded excellent scope for comparison, and the careful observation of individual cases.

Of these 257 cases, 107 were of a very mild or only slightly severe nature, and in many instances gave no opportunity of observing the acute stage for the reason above stated. Where the sore throat, rash, and other typical Symptoms were in Evidence, the temperature in a large number of cases did not exceed 102°, and became normal within a week, remaining so till desquamation was complete (Charts of Cath. Petrie, Geo Moffat, & Willie Clark. See opposite). There were other Patients, however, who did not

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* Compare the very interesting & classical description of the Epidemics in Dublin of 1801-4 & 1834, in Graves's Clinical Medicine 2nd Ed. p. 230 et seq

Name Jane Anderson Age 25 Disease Scarlet Fever (Severe Simple form) Result Cured.

Date: 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 1 2

Day of Dis.: 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Time: M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E

106° 105° 104° 103° 102° 101° 100° 99° 98° 97°

Temperature (Fahrenheit)

Variations of temperature in health

42° 41° 40° 39° 38° 37° 36° 35°

Temperature (Centigrade)

Pulse
Resp
Urine
Bowels

Jany 1st 1897

Name Mary Patterson Age 8 Disease Scarlet Fever (Septic) Result Cured.

June July 1897

Date	13	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12
Day of Ins.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Time.	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E

Temperature (Fahrenheit) — Normal temperature 98⅖

106° 105° 104° 103° 102° 101° 100° 99° 98° 97°

Temperature (Centigrade) — 42° 41° 40° 39° 38° 37° 36° 35°

Pulse
Resp.
Urine
Bowels.

Dr Saville 'Clinical Chart' Copyright.

Name Peter Oithem Age 10 Disease Scarlet Fever (Sulton) Result Cured

Nov. Dec. 1897

Date	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5
Day of Dis.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Time	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E

Temperature (Fahrenheit)

106° 105° 104° 103° 102° 101° 100° 99° 98° 97°

Normal Temperature of Body

42° 41° 40° 39° 38° 37° 36° 35°

Pulse
Resp
Urine
Bowels

Dr Savill's 'Clinical Chart' Copyright.

Feb. March 1898

Name Alice Anderson Age 14 years Disease Scarlet Fever (Septic) Result Cured

Date	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9
Day of Dis.	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Time	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E	M E

Temperature (Fahrenheit)

106° 105° 104° 103° 102° 101° 100° 99° 98° 97°

Normal temperature

42° 41° 40° 39° 38° 37° 36° 35°

Pulse
Resp
Urine
Bowels.

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not come off so easily. In these cases the rash was usually very much brighter, the constitutional disturbance more marked, nocturnal delirium and great restlessness being sometimes present for a few days, while the initial temperature and pulse rate tended to be higher, and the defervescence to last longer. Such patients indeed, were very ill for the time being, but rapidly improved after the acute symptoms passed off. The condition of the throat was that of great hyperaemia, with swelling of the tonsils and tenderness of the glands in the neck, there being, however, no tendency to hardening of the latter, and an absence of marked tonsillar exudation (Chart: Jane Adamson). These patients nearly all made an excellent recovery, and developed no secondary complications. The whole group may be taken as representing the simple or benign form of Scarlet Fever, described by Authors.

Severe Simple Cases.

The next series of cases, amounting to nearly the remainder of the complete record of 257, exhibited on the whole a graver aspect. For the first few days they often resembled severe attacks of the simple form of the disease. The tonsils however, were nearly always covered with patches of pulpy exudation from the crypts, and the glands in the neck swollen hard and tender. Frequently these conditions came to be serious in themselves, the throat ulcerating and discharging large amounts of sticky purulent secretion (Diphtheroid), while the glands in several instances developed abscesses which required evacuation. In other cases the throat affection travelled to the ears and nose. Sometimes the occurrence of acute Otitis media ushered in a tedious Otorrhoea, or the Ears would begin to discharge spontaneously. One patient developed an abscess over the mastoid which required incision. The nose frequently gave trouble, the discharge being often very copious and persistent. Constitutional disturbance was always considerable. The temperature pursued a peculiar course. (Charts of Alice Anderson, Peter Aitken & Mary Patterson). Instead of rapidly falling or gradually defervescing as in a simple case, there occurred a succession of sudden risings and depressions, sometimes regular from day to day, as in a typical remitting fever, or with frequent interruptions, corresponding to the occurrence of the various complications and their

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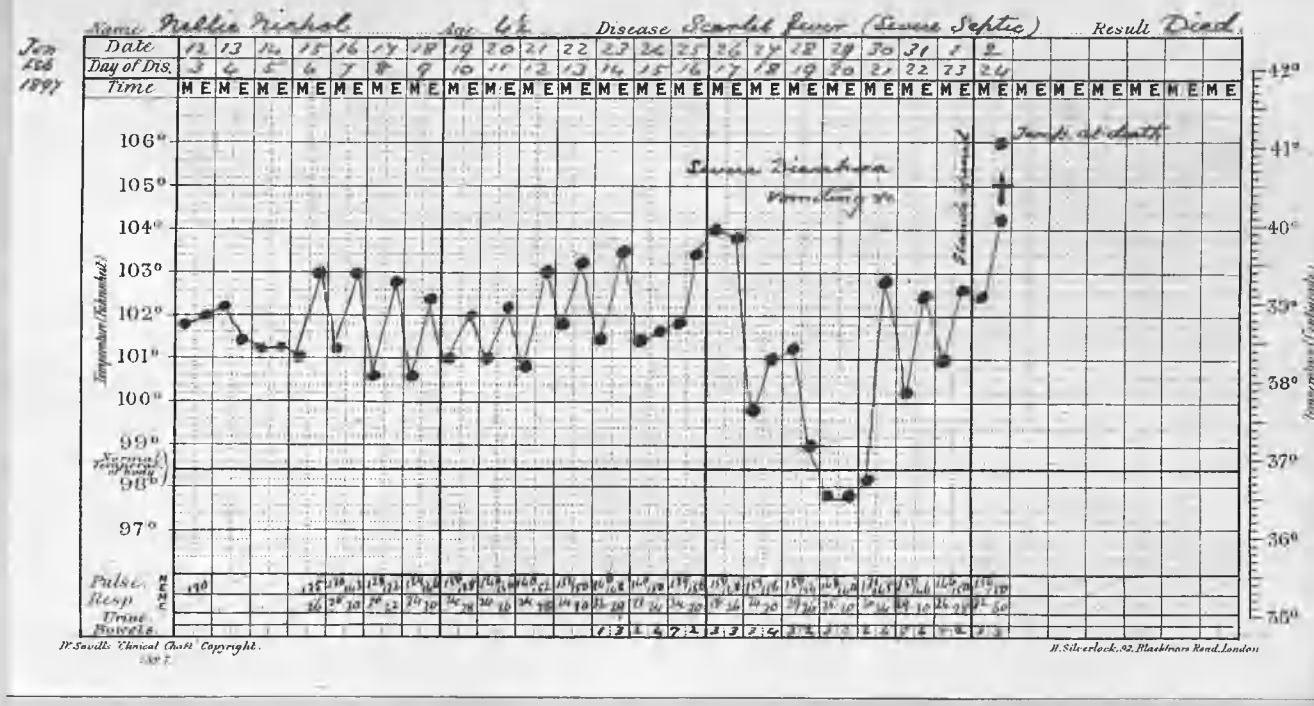
Name Bobbie Nichol
Age 6½
Disease Scarlet Fever (Severe Septic)
Result Died
Jan 26 1897
Date
Day of Dis.
Time
Severe Diarrhoea
Temp. at death
Pulse.
Resp.
Urine.
Bowels.
Temperature (Fahrenheit)
Temperature (Centigrade)
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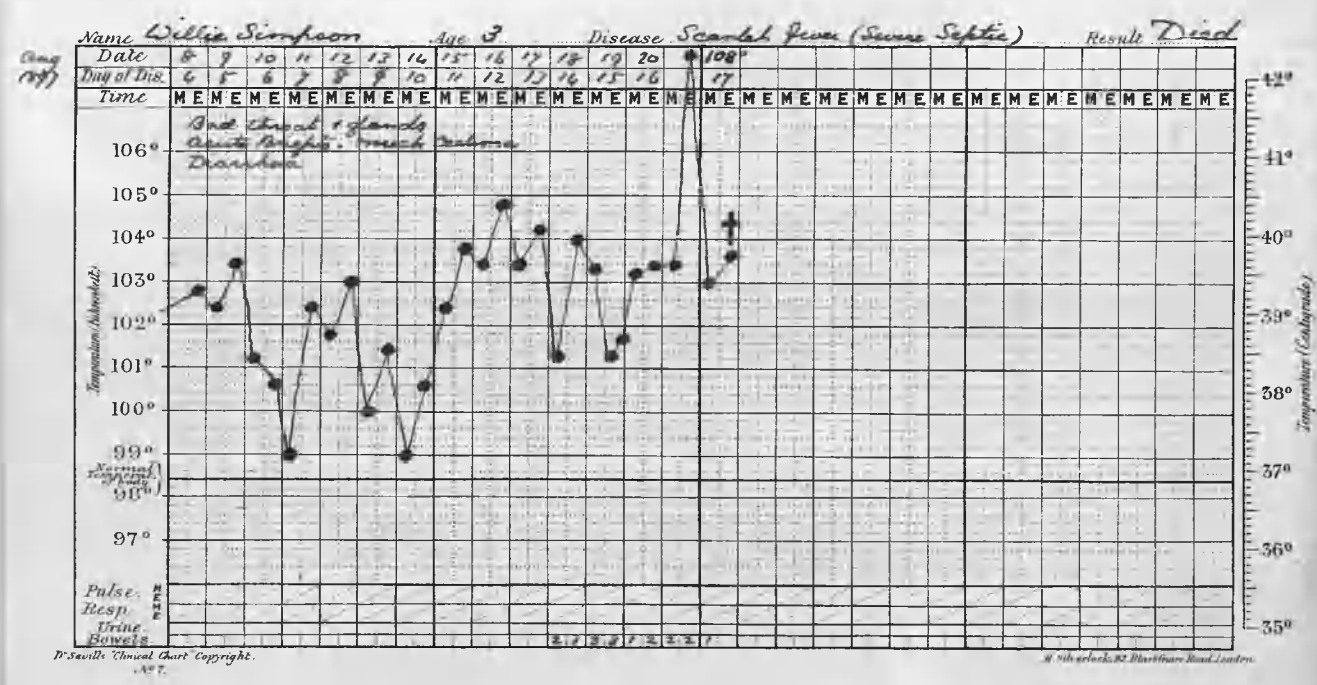
Name Willie Simpson
Age 3
Disease Scarlet Fever (Severe Septic)
Result Died
Dec 1897
Date
Day of Dis.
Time
Bad throat & glands
Acute Bright's. much Coloma
Diarrhoea
Pulse.
Resp.
Urine.
Bowels.
Temperature (Fahrenheit)
Temperature (Centigrade)
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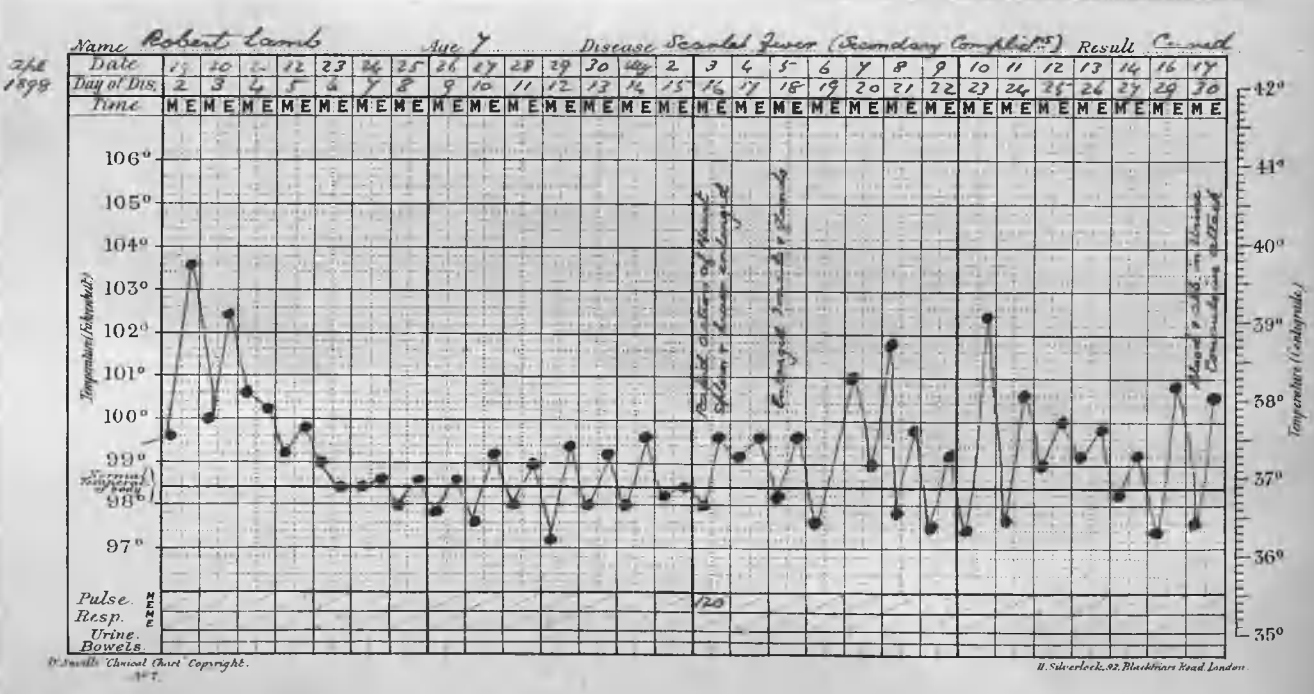
Name Robert Lamb
Age 7
Disease Scarlet Fever (Secondary Complics)
Result Cured
Feb 1898
Date
Day of Dis.
Time
Pulse.
Resp.
Urine.
Bowels.
Temperature (Fahrenheit)
Temperature (Centigrade)
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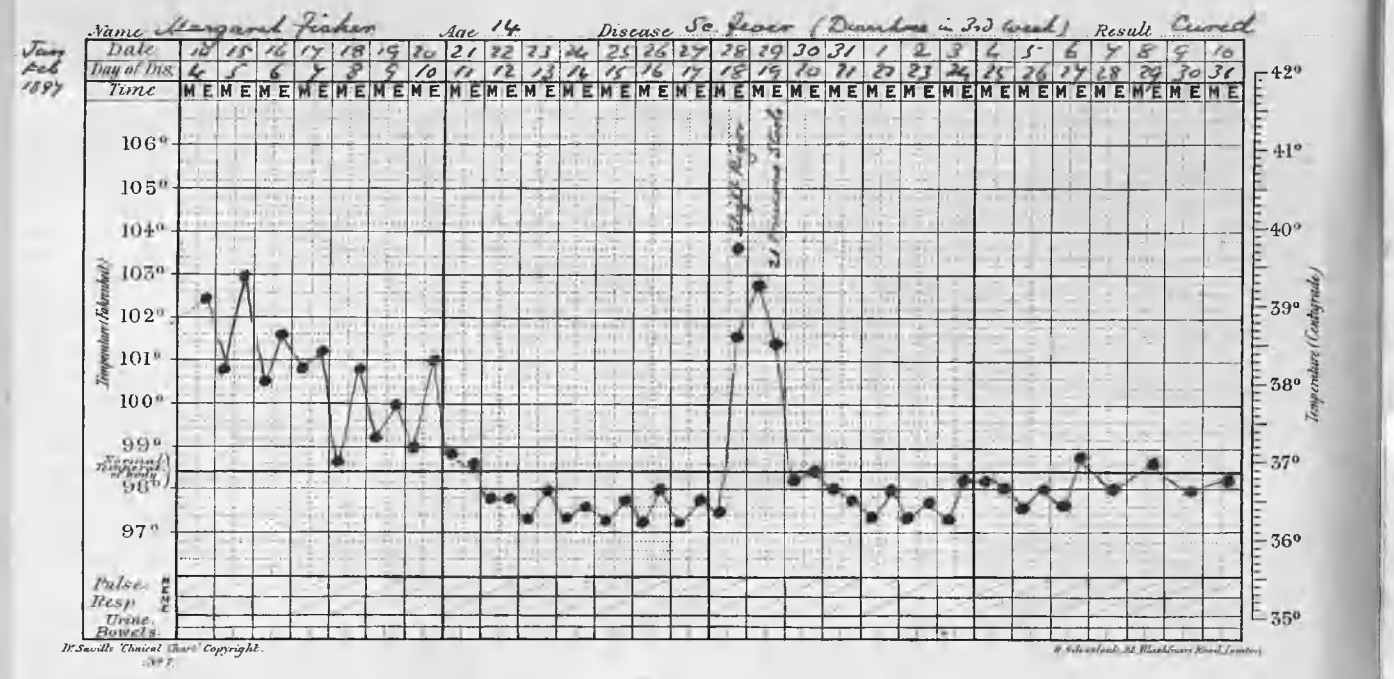
their relief. Notwithstanding the severity of such cases however, final recovery was the rule, the troublesome discharges gradually yielding to treatment, and the constitutional depression slowly passing away, leaving at the worst perhaps a few hard glands in the neck, a perforated drum, or an anaemic complexion. Where death occurred, the cases were characterised by a great aggravation of the symptoms above described, and especially of the constitutional condition. As an example may be given the

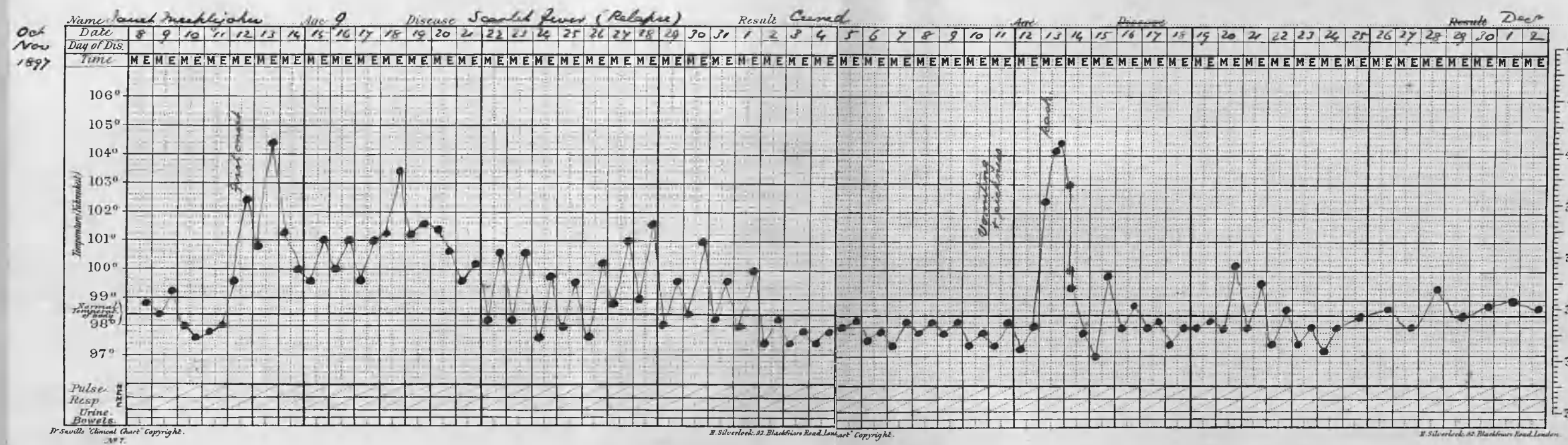
Septic Cases

case of Nellie Nichol (See chart), which exhibited all the Evidence of virulent Blood Poisoning. The throat and nose poured forth secretions, the glands enlarged and formed deep abscesses, persistent diarrhoea & vomiting prevented all nourishment being taken, the Urine was loaded with Albumen, & the face oedematous, the pulse & respiration maintained the highest registers, while the temperature showed the presence of a continued fever rising to 106° before death. Delirium was almost constant, drifting into Coma as the end drew near. The case of Willie Simpson (See Chart) was remarkable for the great height, 108°, to which temperature rose before death, this being the highest temperature of all cases recorded. The complications present were severe discharging throat, exhausting Diarrhoea, great oedema of body with much albumen in the Urine, and the signs of profound disturbance of the vital centres, as in the former case. Other patients who succumbed to this form of the disease exhibited more or less the symptoms which have been mentioned, there being in some a tendency to pneumonia, to Epistaxis, or to the occurrence of secondary atypical eruptions, but all presenting the same dreadful picture of violent Blood infection.

Many of the less severe cases of this class were characterised by the occurrence of late or irregular complications, that is to say, those not directly arising out of the initial symptoms. The acute stage was sometimes mild or only moderately severe, but during convalescence a secondary rise of temperature would occur, accompanied by some distinctive symptom.* Thus, Secondary albuminuria occurred in 7 cases, this symptom being sometimes very persistent, even in spite of all treatment. One girl always developed Albuminuria whenever she was allowed up out of bed (orthotische Nephritis of German authors), and after long detention in the Fever department was

* Chart. Robert Lamb.



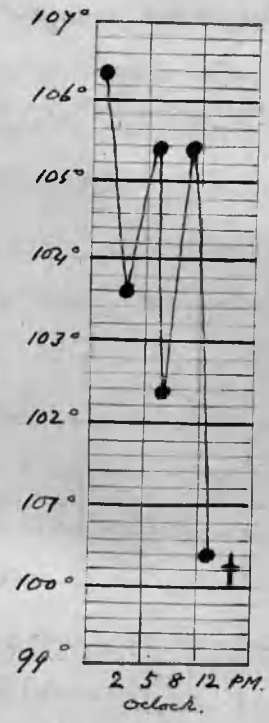

Name Israel Markijohn Age 9 Disease Scarlet fever (Relapse) Result Cured
Oct Nov 1897
Date 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 1 2
Day of Dis.
Time M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E M E

was at length transferred to the general ward, where she remained many weeks before recovery. Rheumatism was observed in six cases, but it never amounted to more than pain and tenderness in the joints, with slight feverishness. Effusion or suppuration was never noticed. Cardiac symptoms were found in 11 cases, not however being always traceable to intercurrent Rheumatism. They consisted chiefly of faint murmurs, irregularity of action, redeplication of 1st or 2nd Sounds, or debility exhibited in Sudden attacks of fainting. One patient developed Pericarditis & died after a long and severe illness. Choreic symptoms were noticed in three children. Severe diarrhoea occurred in 9 patients, being usually accompanied by increased temperature (Chart Margt Fisher). It was never a fatal symptom in itself, but was frequently present among other complications in fatal cases. Simple chest complaints were common, but never serious in themselves. Other minor conditions noticed were phlyctenular ulceration of the cornea, Blepharitis, Scaly skin conditions, & Erysipelas of the face

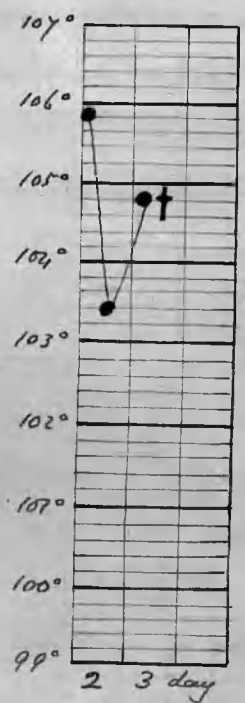
Case of Relapse

One patient exhibited distinct symptoms of Relapse (See Chart. Janet Nicklejohn). She was admitted to hospital feeling ill. After being in for four days, she developed Sore throat, high temperature, and a bright rash, with other typical evidences of an acute but mild attack. The temperature remained fluctuating for nearly 3 weeks thereafter, during which time desquamation was proceeding quite profusely. The temperature now remained about 10 days normal, when after sickness and vomiting a second sudden rise of temperature took place, accompanied by the outburst of a bright Erythematous rash over the arms, legs, and slightly over the chest, which disappeared characteristically on pressure. This attack, however, quickly subsided, but owing to the skin being of a very dry and scaly nature, desquamation was somewhat prolonged, and it was deemed necessary to retain the patient Eight weeks in hospital after her Second attack, her whole stay thus amounting to about 15 weeks. Hirsch * describes several cases of a similar description to this, and cites Thomas (v. Ziemmsen's Handbuch der Spec. Path & Therapie) who divides recurrences of the disease into three groups: ① Pseudo recidive, when during the persistence of protracted fever, a second outbreak of the Exanthem occurs. ② True Recidive, when after disappearance of fever, but without complete recovery, the first illness, with Exanthem, Desquamation and other phenomena again arises ②

Jeannie Fisher (age 3)



Helen Penney (age 11)



Malignant or Toxic Scarlet Fever.

arises ② Second attack, it may be years after the first. The case of Janet Mucklejohn was plainly referible to Group 2 of such a Classification. Examples of a true Second attack are considered by all authorities as very rare. Several patients who came under our own observation were said to have suffered from a previous attack, but in no case was the evidence strong enough to exclude the possibility of error. The frequency of erythematous eruptions in children, often accompanied by feverishness, and the strong resemblance that certain forms of Rötheln have to Scarlet fever, are very misleading circumstances. The impossibility of proving the true nature of the first supposed attack is the great difficulty in the estimation of such cases.

During the height of the Epidemic a small outbreak of measles occurred in the Wards, owing to a case of this disease having been sent in as Scarlet fever. Over a dozen patients were attacked but in no instance did serious symptoms develope. There was no Evidence to support the idea that the occurrence of measles during the course of Scarlet fever is a grave complication, although this is held by some authorities (e.g. Caiger).

A few children were attacked by Chickenpox during their stay in the fever wards, In one case only did the disease become at all severe, large abscesses forming in several parts of the extremities, which required surgical interference.

It was not noticed that the character of either of these diseases was at all modified by their occurring during the course of Scarlet fever.

Toxic Cases

The last and most remarkable form of Scarlet fever was represented by only two examples. The first of these (Christina Fisher) was an infant of three, who was admitted on the second day of illness in a comatose condition, and with a temperature of 106·4°. She showed few of the typical symptoms of the disease, the rash being quite of an anomalous description. After sponging, the temperature dropped to 103·6°, rising again towards night to 105·4°. A tepid bath was next tried, which caused a second drop to 102·6°, only to rise again shortly after to the same height. After vomiting the temperature fell Spontaneously to 100·4°, death ensuing shortly thereafter, the patient never regaining consciousness. The whole duration of the attack was thus inside of three days. The second case was a girl of

Eleven (Chart. Helen Penney) also admitted on the second day of illness. Her temperature, when first seen, stood at 105·8°. She suffered from a severe throat condition, with enlarged glands, and from a condition of violent delirium she drifted into coma, and died early on the day following admission, her whole illness thus lasting in all about 2½ days.

These two cases conformed to the malignant or toxic type of different authors, their whole aspect being that of acute blood poisoning, the characteristic group of Scarlet fever Symptoms being little in evidence.

Mortality observed

The mortality of all cases was 12, being about 4½ per cent, the relative ages being 6 at 3 years or under, 1 at 4½, 1 at 5, 2 at 6, 1 at 8, and 1 at 11 years, the marked fatality for infants being very noticeable. The above percentage of fatal results is a low one, the average mortality of Scarlet fever being about 10% (Squire). Epidemics, however vary much in this respect, and some may show a mortality of almost 0, while others may mount up to 30 p. cent (Jürgensen).

It will thus be seen that the record of cases referred to embraced all the well known forms of Scarlet fever, and included examples of most of the complications commonly met with. Their classification and significance will be afterwards discussed when considering the questions of Etiology and Mixed Infection.

Etiology 3

Etiology :-

The remarkable advances which have of recent years been made in our knowledge of the Etiology of disease, are chiefly in the domain of Bacteriology. It is unfortunately the case however, that with regard to many of those very diseases which to all appearance seem most clearly due to an organic agency, and which we provisionally term Zymotic, no such origin has as yet been demonstrated. We are still quite in the dark as to the ultimate cause of Smallpox, Scarlet fever, Measles & the other Exanthemata. These are all diseases which have many features suggestive of a microbic basis. They are markedly infectious, and spread in epidemic waves. They have a well defined incubation period, followed by a sudden outburst of symptoms and a subsequent decline. The contagium is carried by fomites, and is readily destroyed by disinfection; while careful isolation hinders the dissemination of the disease to others, and a single attack confers to the individual more or less future immunity. In many respects, also, these diseases resemble others which have already been explained on bacteriological lines, such for instance as Influenza, Diphtheria, and Enteric fever; and this is further presumptive evidence that they also admit of a similar explanation. Such an explanation, however, has not as yet been arrived at, and we still eagerly await the results of future investigation.

With regard to Scarlet fever, at any rate, failure has not been due to the lack of Earnest enquiry. For many years this disease has been made the subject of the most painstaking bacteriological research, and again and again have investigators brought forward claims to have at length discovered the Specific organism of the disease, but their results have not sustained careful re-examination. The literature on the question is voluminous, and it will be impossible to give more than a brief resumé of the more important investigations which have been made during recent years, with a view to indicate the present position of this very interesting enquiry

Amongst

(a) Supplement to Annual Report of the Local Government Board, containing Report of Medical Officer.
1886. page XIV &c

(b) Ditto: _____ 1887 p XV. &c

(c) Ditto: _____ 1896-1897

(d) Ditto: _____ 1899.00 page 400.

(e) British Medical Journal:—
11 June 1887 and 6 August 1887

Klein's Researches

Amongst the Earliest and most important researches upon the bacteriology of Scarlet fever have been those of Dr. Klein, which were first undertaken in connection with the prevalence of Epidemics of the disease during 1885 in Hendon, Marleybone, and other parishes in London.[a] It had long been suspected that outbreaks of Scarlet fever sometimes had their origin in morbid conditions occurring in Cows, whose milk was apparently the means of spreading the disease. On investigation it was found that the consumption of the milk of certain cows kept at a farm in Hendon was definitely associated with the occurrence of cases of Scarlet fever. These cows suffered from a disease characterised by discharging sores on the teats. In the discharges from these sores Klein found micrococci, which when inoculated into calves produced disease similar to the Hendon disease, and also, as he claimed, similar to human Scarlet fever. The conclusion Klein arrived at was "that "the Hendon disease is a form, occurring in the cow, of the "very disease that we call Scarlatina when it occurs in "the human subject." These investigations were continued by Klein and others during 1887[b] in connection with an Epidemic of Sorethroat which arose in Edinburgh and which was also traced to disease in the Cow. At the same time a minute enquiry into the whole group of the Streptococci was made by Klein, inorder to differentiate the Streptococcus or micrococcus Scarlatinae, as he called the germ, from all other forms; and he was able to adduce a considerable amount of Evidence that this organism is the contagium of Scarlet fever.[c] It may be mentioned that his results were afterwards confirmed to a large extent indirectly by a German observer Kurth, who in 1891 described an organism occurring in the throats of Scarlet fever patients, which Klein admitted to be identical with his own.[d]

Edington & Jamiesons Researches

In the meantime two other investigators, Drs Jamieson and Edington of Edinburgh, had published a series of enquiries into the contagium of Scarlet fever[e], in which they brought forward another candidate in the form of a Bacillus (the B. Scarlatinae). They claimed that they had "pretty well proved "that this Bacillus Scarlatinae is the specific cause of Scarlet "fever." The chief Evidence adduced was that this organism occurred in every cultivation but one made from desquamated

Klein ?

(a) British Medical Journal 30 July 1887

(b) Ditto: _____ Oct 15. 1887. p. 831.

(c) Ditto: _____ 20 Augt 1887. p. 402

(d) Ditto: _____ 17 Decr 1887. p. 1317. &c

(e) Lancet . 18 Nov. 1899.

Skin, and in every cultivation made from the blood of Scarlet fever patients; and that inoculation of these cultivations produced a disease resembling Scarlet fever in small animals. These discoveries created such interest that a Special Committee was appointed by the Edinburgh Medico-Chirurgical Society to make full enquiry into their value, and to carry out experiments on similar lines.(a) The result of these investigations was that the Committee "failed to corroborate the conclusions "arrived at by Dr. Edington as to the pathogenic value of the "bacillus Scarlatinae." (b)

This Committee also found that one of the organisms described by Edington + Jamieson, but rejected by them as not being the likely specific organism of Scarlet fever, was identical with the Streptococcus Scarlatinae of Klein. It will thus be seen that the whole question at this stage was in a most confused and contradictory condition.

Klein's results Criticised

Klein's results were meanwhile being subjected to very severe criticism from other sources. Dr. George Thin, of London, in a long paper(c) read before the British Medical Association at Dublin in August 1887, pointed out very clearly the weak points in Klein's chain of Evidence. He showed that Klein had not proved that his organism when isolated could produce Scarlet fever in man, nor that animals were capable of developing the genuine disease, & of communicating it to man; and further, that it had been in no degree proved that the organism was always present in Scarlatinal blood and tissues, and nowhere else. Professor Cruickshank, in a Report read to the Agricultural Department of the Privy Council(d) gave it as his opinion "that the Hendon Cow disease "was not Scarlet fever in the Cow, and that in the Hendon "milk the source of infection was from some hitherto unascer-"tained human source;" thus striking at the very foundation of all Klein's researches. He even came to the conclusion that the disease in the teats of the Cows was actually the true Jennerian Cow pox. Other eminent Pathologists have further attacked the identity of the Streptococcus Scarlatinae itself, and it is the conviction of many such even at the present time that it is simply Strept. pyogenes under another name.(e)

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(a) Supplements to Loc. Soc. Reports of 1897.8 & 1898.9.

(b) Ditto: _____ 1899.1900 pp. xvii. 385 et seq. - 587.

With great pertinacity Klein has continued his investigations during successive years, and in his Recent Reports to the Local Government Board has described the results he has arrived at. In answer to his Critics he claims that the Microorganism which he has isolated is distinguished by definite characters from the other members of the Streptococcus group, and especially Strept. Pyogenes. These cultural peculiarities are ① That in broth a peculiar nebulous mass of threads of cocci gathers at the bottom of the tube ② That milk is readily coagulated by the Coccus, and ③ That in agar cultures colonies tend early to develope nodules. ④ He bases his conclusions as to the Specificity of this germ upon a large number of observations carried out upon Scarlet fever patients during a number of years. He declares first of all that he has been able to find this Streptococcus constantly in the throat discharge of acute Scarlet fever, and adds his belief that "its presence in the acutely inflamed throat of the "human subject may be regarded as denoting Scarlet fever "in just the same way as under corresponding throat con"ditions the Diphtheria Bacillus is accepted as diagnostic of "Diphtheria". On the other hand the germ is not found in normal throats or in inflamed throats not Scarlatinal. In the later stages of the disease the germ is "apt to be "found in the throat and nasal discharges"; but he has not been able to obtain it from the desquamating skin or the Urine, nor from the aural discharge. Inoculation of the germ into the lower animals produces lesions resembling those found in certain cases of Scarlet fever. Thus, in mice it produces Septicemic infection, and death in a considerable number of cases in from a week to a month, and the microorganism can be recovered from the blood and viscera. In rabbits a temporary edema and redness is produced locally, but no Erysipelas nor abscess results.

Dr Gordon's Views

In the Report last issued ① a long communication is given by Dr Gordon upon investigations carried on by him in continuation of those by Dr Klein. His object has chiefly been to confirm the results achieved by Dr Klein. He claims that all his enquiries tend to support the contention that Strep-

tococcus

(a) Berliner Klinische Wochenschrift - 2 July 1900. p. 588 et seq.
Ditto: ——— 9 July 1900 p 618 et seq. "Ueber einen constanten
Bactericnbefund bei Scharlach." (Baginsky + Sommerfeld.)

"tococcus Scarlatinae is both a distinct organism from the "Strept. pyogenes, and also that it is causally related to Scar: "latina." Dr Gordon, however, makes an interesting admission in a footnote, which perhaps gives us the best indication of the present position of these researches. While contending that everything points to the probability that the Strept. Scarlatinae is the "specialised and essential agent" of the infection of Scarlet fever, he will not allow that the organism as yet merits the Epithet "Specific". The term, he says "is, for the present, better "avoided." (page 453). It must be confessed that such a reservation is somewhat disappointing after the very strong affirmations made by Klein in his own report on the Subject.

Baginsky + Sommerfelds Researches

Within recent months another group of observers has come forward with claims to have discovered "a constant "Bacterial result in Scarlet fever." At a meeting of the Berlin Medical Society held in June 1900, Professor Baginsky and his assistant Dr Paul Sommerfeld gave a long & interesting communication upon a large number of investigations made by them during a recent severe Epidemic.(a) They claim to have found a constant microbe associated with the early sore throat of Scarlet fever patients in 336 cases out of 363 examined. They also found it in the blood and viscera and in the cerebro-spinal fluid of 62 fatal cases, which included a group of violently malignant and rapidly fatal attacks, in which secondary complications had not time to develope. This microbe appears in the form of long & short chains, and sometimes as a Diplococcus. It behaves in its cultural and biological relations like the other members of the Streptococcus group. As regards virulence and pathogenicity these were found extremely variable. Sometimes very small doses were sufficient to kill small animals. In other cases large doses were quite innocuous. As regards the question whether this organism stands in direct causative relation to Scarlet fever, or is only of indirect significance, Baginsky is of opinion that no conclusive answer can be given. The fact remains however, that in Every case of this disease a Streptococcus can be demonstrated in the blood and organs,

even

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* The Lancet. Sept 20. 1900 p. 927 &c

even in non-complicated cases, and this circumstance, he adds, will have to be reckoned with in all future investigations. He was unable to demonstrate the specificity of this particular germ, partly because the susceptibility of animals to Scarlet fever is in itself quite problematical, and it could therefore hardly be demanded that it must be reproduced in them. Everything, however, being taken into account he concludes that there is "no other choice "but to acknowledge that the Streptococcus belongs to the "Scarlet fever process." (page 619)

Dr. Class's Researches

Shortly before these observations of Baginsky and Sommerfeld were published, Dr. Class of the Chicago Health Department had contributed an article to the Chicago Medical Record, describing a number of extraordinary discoveries which he claims to have made in reference to the question at issue. After many trials he states that he succeeded in isolating an organism from the throats and desquamating skin, and the blood, of Scarlet fever patients, which he believed to be the specific microbe of the disease. In a subsequent article in the Lancet* he further states the germ to have a marked similarity to that described by Baginsky & Sommerfeld, although he is unable to prove it identical. Indeed he rather leans to the opinion that there has been no previous description of a germ exactly resembling the one described by him. He forms it is a Diplococcus resembling a large Gonococcus, which only rarely assumes the form of a Streptococcus. He states that he found it in 300 successive cases of Scarlet fever, & Scarlatinal Sore throat; and boldly claims to be absolutely certain of his "ability to demonstrate the presence of this Diplococcus Scarlatinae "in the blood, throat, secretions and scales of every typical case "of Scarlet fever given him for examination." He further makes the important statement that this is the first germ ever discovered which can produce a disease apparently identical with Scarlet fever in animals. He employed white Swine as the subjects of experiment, and found that within a few days after inoculation they developed a rise of temperature and other febrile symptoms, followed by a reddening of the skin lasting for several days, and profuse scaling in the course

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(a) British Medical Journal 10 Sept. 1898

"Treatment" May 1900. "Infection through the Tonsils". Packard.

(b) Vierordt. "Diagnostik der Innern Krankheiten" - 1901. page 298 &c

of a week or two. He adds that he has produced the disease in a sufficient number of cases to exclude the possibility of its being an accidental phenomenon; and he further makes the extraordinary claim that it is actually of a contagious nature in these animals, having spread from two diseased swine to another healthy one placed in the same cage. Dr Class brings forward important evidence to prove that the pathological changes in the organs caused by this Diplococcus resemble those of Scarlet fever. In regard to the cultural peculiarities of the organism he finds that it does not coagulate nor produce any change in milk, a point which he considers consistent with the well known tendency which Scarlet fever has to spread by that medium. He was also able to demonstrate the microbe in the blood & urine of a patient suffering from Surgical Scarlet fever. He concludes by asserting that he believes his Diplococcus Scarlatinae to fulfil all the four postulalis of Koch, and that it is entitled to serious consideration by all engaged in the study of the Etiology of Scarlet fever.

Class's Results Criticised.

There is no doubt that if these striking discoveries of Dr Class can be verified, the "Diplococcus Scarlatinae" may well be looked upon as having a serious claim to be the microorganism of Scarlet fever. It can hardly be admitted however that he has satisfactorily demonstrated its Specificity. He contends that his germ is found in all cases of Scarlet fever and Scarlatinal Sore throat, but he does not prove that it is absent in non-Scarlatinal Tonsillitis and in the normal throat. Indeed he admits that it is present in cases of simple sore throat occurring during an Epidemic of Scarlet fever, but contends that this is rather a proof that his germ is Specific, as he considers it probable that these cases are merely Scarlet fever without the rash. This looks like arguing in a circle, and attempting to prove one theory by another. It is well known that ordinary "Catarrhal" Sore throat is associated with the action of micro-organisms and the term "Streptococcic" Angina has even come to be used by certain writers as a distinctive title for some varieties of this disorder.(a) It is also an undoubted fact(b) that a vast variety of

bacteria

G. Courtois. These de Paris, "Streptocoque et Scarlatine", Essai de Sérothérapie expérimentale. Paris 1899.

bacteria exist in the normal throat, especially of children, and that many of these are capable of taking on a virulent action under favourable circumstances. Such being the case it is incumbent upon any one who claims to have discovered the germ of Scarlet fever in the throat to demonstrate that it is distinct from all other organisms found in that region both in health and disease.

Courtois' Researches

The investigations of G. Courtois (1899) should not be passed over, though they are still somewhat inconclusive. He undertook a careful examination of the urine & blood of Scarlet fever patients in order to discover their bacteriological nature, and he claims to have discovered a Streptococcus in the Urine which he says "may perhaps be the infectious "agent of Scarlatinal Nephritis." In the blood he also found a Streptococcus, which, however, was not absolutely identical. His microbe was specially found in albuminous Urines, & Courtois is of the opinion that it is subjected to some change in passing through the kidney. It was found to be pathogenic for rabbits, producing at once a general infection, and rapidly killing the animal. Though possessing quite characteristic features, he found it difficult to distinguish this microbe from the Streptococcus pyogenes and that of Erysipelas. He was able also to isolate a toxic principle from the Urine, above all at a certain period of the disease, about the 12th or 15th day, which is probably elaborated by the microbe, and which he terms "Streptococcine". Inoculated into Rabbits this toxcine enabled the animals to react against the Streptococci, producing a degree of immunity for various periods - This result, Courtois thinks, proves that the Streptococcus plays a great pôle in the pathogenity of Scarlet fever. The same difficulty arises in regard to these investigations as is met with in all similar researches, viz that it is impossible to decide whether the Streptococcus in question is the true Specific Organism of the disease, or is merely one of the many factors which are concerned in the production of secondary complications. This undoubtedly is one of the great problems still to be solved in connection with the bacteriology of Scarlet fever.

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(a) Compare Henoch's remarks upon this subject. Vorlesungen über Kinder Krankheiten 1899. page 655 &c

(b) Berliner Klinische Wochenschrift. 9 July 1900. page 627

(c) "Die Deutsche Klinik": 3 Vorlesung. "Die Infection." Band 1. Lieferung 1. page 46.

Estimation of present position of Bacteriology

In attempting to estimate the present position of the Bacteriology of Scarlet fever, it must be remembered that it is after all quite a gratuitous assumption that the disease is due to a micro-organism morphologically similar to those already known, or demonstrable by present day methods.(a) Evidence is not wanting, as Wassermann has pointed out,(b) that there are some infectious diseases which are due to a contagium of some kind or other which is invisible to the highest powers of the microscope, and which filters through a medium that retains the smallest known bacteria. It may be that the germ of Scarlet fever has somewhat of this character; and the extreme infectiousness of the disease, the rapidity of its spread, and the general 'evasiveness' of its action, render some support to the idea. Many considerations, indeed, point to the possibility that the whole group of the Exanthemata have for their basis some contagia differing in their essential features from the common type of micro-organism, and it may be that, as in the case of the tubercle bacillus, special methods will have to be devised before these can be isolated & made clearly demonstrable.

With regard to the observations which have already been made, it is remarkable that in nearly all cases Streptococci have been discovered to be associated with the Scarlet fever process. Besides the investigators already mentioned, we find the names of Crooke, Fraenkel & Freudenberg, Babes, Raskin, Brunner, Caddy & Cook, Stooss, Coze & Feltz, Pohl & Pinkus, Delmoine and others amongst those who have met with different varieties of micrococci in the disease. The conclusion indeed may be safely arrived at that these organisms have some intimate relationship to the phenomena of Scarlet fever. It does not follow, however, that some form of Streptococcus is necessarily the specific cause of these phenomena. The organisms may be only accidentally present, or be causally related merely to the secondary complications of the disease. Streptococci and Staphylococci are, unfortunately amongst the commonest of all pathogenic organisms. As Professor Dönitz says(c), "they press "upon us from all sides, and there is not any one who does not "harbour them somewhere in his body, so that they are always at hand to do us ill when the opportunity offers". Though possessing

(a) Berliner Klinische Wochenschrift - 9 July 1900. p. 619.

(b) Die Deutsche Klinik. Die Infection. loc. cit. p. 61.

(c) Berliner Klinische Wochenschrift. 1895. Nos 23 et seq. "Ueber Wundscharlach" (Brunner). See especially the last article of this Series containing reference to article by Rosa Engelmann (Journal of American Med. Assoc. March 1895)

:ing sufficient morphological similarity to form a group, there is no doubt that a great variety of different germs present themselves under this aspect. Klein has spoken with Emphasis upon the vast labour required to differentiate the various species, and Baginsky even goes the length of saying that the different Streptococci cannot be distinguished by present day cultural methods, the varying forms and sizes of chains and cocci, & the peculiarities of growth on Potatoes or in Milk being no reliable distinctive features. (a)

Streptococci & Sc. fever

It is unfortunate also, that Streptococci have not been found in other cases to show any marked specificity. We find, for instance, that "the same Streptococcus which pro: :duces an abscess, at another time brings about an Erysipelas "or a Lymphangitis." (b) Again, Brunner and Rosa Engelmann even go the length of suggesting the possibility of the bio: :logical identity of the Streptococcus of Suppuration, Erysipelas, and the supposed Streptococcus of Scarlet fever. (c) In Scarlet fever we constantly meet with lesions, which occurring under other circumstances, we would put down to non specific causes. There is every reason, as will afterwards be seen, for considering the secondary complications of Scarlet fever to be largely Septic in their origin, and it would therefore be expected that Streptococci would be abundantly present in cases exhibiting such complications. Most investigators have been fully alive to this difficulty, and have endeavoured to select the cases from which cultures were made, in order, if possible to exclude Septic organisms. But they have in no wise restricted themselves to the simple, uncomplicated forms of Scarlet fever, which are really the only cases in which there is any pre: :sumption that the contagium exists in some degree of purity. To attempt, as some have done, to isolate a Specific organism from the malignant forms of the disease does not seem to offer much chance of success. The idea held is probably this, that such cases, on account of their great severity will be certain to yield more pronounced evidence of the specific organism, whatever it may be. But, inasmuch as they diverge furthest of all from the typical form, the likelihood is rather that some other Element has Entered in ?

(a) "a dog has contracted fever + sore throat from being in bed with "a Scarlet fever patient, and pet animals can carry infection from "one person to another." (Quain's Dictionary of Medicine. Art: Sc. fever. Squire)

(b) Ashby + Wright "Diseases of Children" p. 286

in, and become predominant. These are the very cases in:deed, in which we would sooner expect to find some very malignant but common form of Streptococcus, than the Specific organism of Scarlet Fever. The latter ought surely to be sought for where there is least possibility of admixture with other pathogenic organisms.

Sc. Fever + experiments on Animals

There is another great difficulty which stands in the way of the determination of a Specific organism in Scarlet Fever, viz, that we are not in a position to make experiments with cultures upon the human Subject. Scarlet Fever, unfortunately has not been shewn to occur spontaneously in the lower creation. We have but little proof, for instance, that domestic animals ever contract the disease from children or others who may be playing with them while ill.[a] Diphtheria is said to occur in Epidemics amongst cats,[b] and we know that Tubercle and other specific diseases attack various animals. If we had such evidence with regard to Scarlet Fever, much would be gained by way of giving data for comparison. Scarlet Fever, however, is of such a nature that its Symptoms would not be distinctive in animals. Class's experiments with white Swine certainly have some value, but as yet they do not appear to have been sufficiently confirmed. The morbid conditions which have been described as occurring in guinea pigs, calves and rabbits, after injection of Scarlatinal discharges and cultures, bear little resemblance to the typical disease in man; and less can be based upon Post Mortem Evidence, owing to the absence of distinctive lesions in the internal or:gans. Indeed the results adduced cannot be said to exclude the contention that the animals experimented upon died of Septic poisoning. The absolute Specificity of the nexus of Symp:toms which constitutes Scarlet Fever in man stands in glaring contrast to the indefinite results which have been achieved by the attempts to transfer the disease to animals. Until Scarlet Fever, genuine and unequivocal, has been reproduced, or is discovered to occur Spontaneously in the lower animals, nothing less than experiments on the human subject can carry absolute conviction. The possibility of utilising Serum therapy as a means of proving the Specificity of a given organ:ism

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[2] Berliner Klinische Wochenschrift. 9 July 1900. p. 627

[1] Die Deutsche Klinik. 2 Vorlesung. Die Infection (Donitz) p. 53.

:ism has been suggested by Wassermann, "by seeing whether "an Immun-Serum, won from the Scarlatina-Streptococcus, would "leave all other Streptococci uninfluenced or not." (a) It has been mentioned that Courtois has carried out various experiments with Scarlatina-Streptococcic Serum upon Rabbits, but he makes no pretention to have discovered an Immune Serum for Scarlet fever, and he made no experiments upon the human Subject. This therefore remains a field for the future investigation of Bacteriologists. Wassermann looks upon it as a hopeful field, but Baginsky, who had already made experiments in this direction was unable to report any decisive result.

Koch's laws

When we come to put the results which have been achieved by various observers to the test of Koch's laws of Specificity, it can handly be said that any of them quite withstands the ordeal. Dr Class makes strong claims for his Deplococcocus, that it completely fulfils these postulates, but it cannot be admitted that he has proved the strictly typical Scarlatinal Symptoms in the human subject to be directly due to this organism. The same may be said of Klein's Strep. tococcus. Whether it is really possible to demonstrate this point at all is, however, problematical. Typical Scarlet fever is a disease, the symptoms of which have more the appearance of being due to a toxin circulating in the blood, than to a distribution of organisms producing specific lesions in the organs and tissues. Unlike Tuberculosis, Diphtheria, Enteric fever, and other bacillary diseases, it exhibits no characteristic localised morbid processes. There is no nodule, false membrane or ulcer in which to seek for a definite exciting cause. Bacteriologists, it is true, always select the throat as the prob:able focus of the infection. It has been shown that this is one of the regions most favourable for the entrance of bacteria in children, these organs being generally large, and covered with indentations upon which the bacteria can alight and remain a certain time undisturbed, being further pressed into the mucous membrane by the movements of swallowing. (b) It cannot, however, be contended that the Pharyngitis or Ton:sillitis of Scarlet fever, shows any markedly specific features. The contention of Klein, however, that his Streptococcus con:glomeratus

(a) British Medical Journal. 20 Augt 1887. p 405.

(b) Loc. cit. page 41.

:glomeratus is always found in Scarlatinal Sore throats and never in normal throats nor in inflamed throats not Scarla:
:tinal is an important point. This of course is a large as:
:sumption, but as Geo. Thin remarks, the more this fact be:
:comes apparent, then so much more & more probable it would appear that this Coccus was the cause of Scarlet Fever.[a]

Differences in Results

It is unfortunate that amongst so many Eminent observers there is as yet so little unanimity. Their results differ far too much to suggest the idea that they have all discovered the same organism under different forms & conditions. We have seen that Klein's Streptococcus differs from Edington & Jamieson's bacillus. It also differs from Class's Diplococcus inasmuch as the former coagulates, while the latter does not coagulate milk. It is probable that Class and Baginsky are on the same tract, but it can hardly be said that Baginsky makes anything like the claim which Class does for his organism. Countois' Streptococcus again, apparently differs from the others in being the only one clearly present in Scarlatinal Urine. The oldest and most continuous researches are certainly those of Klein, and there is much in the Evidence which he brings forward, supported by his strong personal con:
:viction of its value, to induce the non-expert to accept the Streptococcus conglomeratus as the probable Specific micro:
:organism of Scarlet Fever. The best authorities of the present day, however, will not admit that the problem has yet been solved. Dönitz is inclined to be hopeful about Bagin:
:sky's Coccus[b]; and the Editor of the Lancet looks favourably on Class's results; but it is very evident that much confirma:
tory research is required before the true nature of the Contagium of Scarlet Fever can be established in the position which has been gained for that of Diphtheria or Even Influenza. In the meantime the exhaustive research which has been made is not without its value. Some light has certainly been thrown upon an obscure region of Etiology, and many useful facts have been discovered regarding the Scarlatinal process and its varied manifestations, some of which have an important bearing on Symptomatology and Treatment.

Mixed Infection

(2) Some authorities carefully distinguish Mixed from Secondary Infection, the former occurring simultaneously with the original infection while the latter takes place during the course of the primary disease. (See Article by Kanthack in Gibson's recent Text Book of Medicine vol I. p 28)

(2) E.g. Moore in Gibson's Text book. Bristowe &c.

(3) Some confusion has arisen by the application of the terms "Diph: theria," false membrane, "membranous exudation" in cases of Scarlt fever characterised by the presence of patches or layers of exudation on the pharynx & tonsils. We are indebted to Professor Huebner of the Charité Hospital in Berlin for showing the distinction between the true (Loeffler) bacillary Diphtheria & the patchy throat of Scarlatina. The former, however, is by no means excluded as a possible complication of Scarlet fever. Ref. in Friedrichs' "Rhinologie, Laryngologie & Otologie 1899" p 101
also in Thesis (Geneva) by Halatcheff "Scarlatine Maligne pseud's Diphtérique 1896

Mixed Infection, &c.:—[1]

In the introductory Section of this Thesis, a sketch has been given of the main typical Varieties of Scarlet Fever. The old and almost classical division of cases into, Simplex Anginosa and Maligna is still adopted by some modern writers,[2] and being founded on clinical phenomena, it has the advantage of involving no theories. The present tendency however, is to attempt to base the classification of the various forms of disease upon pathological conditions, and in the case of Scarlet Fever we are not altogether without the means of doing so, although the ultimate pathology of the disease is as yet somewhat obscure.

Types of Sc. Fever.

Although the various clinical forms of Scarlet Fever merge into one another, there are three broad types of the disease which admit of being clearly distinguished according to the nature of the infection. There is no doubt, in the first place, that in the great majority of mild attacks the infection is a simple one. The disease betrays itself in a series of well defined typical symptoms, comprising sore throat rise of temperature and pulse, Scarlet rash, "strawberry" tongue, and finally desquamation, with complete recovery. In such a case we are justified in believing that the Scarlet Fever contagium alone has been at work. The group of symptoms gives us the picture of a Specific disease, caused by some specific organism. The rash, it is true, with its accompanying profuse desquamation, may be the only symptom which in itself is absolutely characteristic, but it is associated with other symptoms which taken together make the picture complete.

In a large number of more severe cases, however, we have clear signs of some secondary influence at work. There is a deviation from the strict type of the disease. This is first observed in an aggravated condition of the symptoms affecting the throat. The tonsils become much enlarged, and covered with white patches.[3] The glands give evidence that they have been called upon to absorb some poison from the adjoining mucous membranes of the Pharynx. These mucous surfaces remain congested and discharge purulent material.

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(a) Compare the very graphic description of malignant cases in Baginsky's "Lehrbuch der Kinderkrankheiten". 1892 page 111.

(b) Henoch's Vorlesungen. 1897. p. 675.

* Cf. Jürgensen, "Acute Exantheme". remarks upon "den Fällen leichtester Art."

(c) Compare Henoch's remarks. Vorlesungen 1899 p. 656.
also "Gerhardt" Lehrbuch der Kinderkrankheiten 1897. Bd. 1. p. 114.

(d) Flügge. "Die Mikro organismen" 1896 vol 1. 311. 312 pp.
Dönitz. (Deutsche Klinik. loc. cit. page 62)

The inflammation may spread from the throat to the nose and Ears. Not only so, but distant organs are sometimes involved. The kidneys may become congested or acutely inflamed, while the synovial membranes of the joints may come in for a share in the poison. Where such secondary symptoms are severe the temperature is fluctuating and frequently high, while there is much constitutional disturbance. In a few instances death may occur, it may be after weeks or months of illness, the patient becoming weakened by long continued discharges or the gradual involvement of the vital organs in the morbid process.

Toxic Cases

In a third group of cases the disease presents the most alarming features. (a) The typical Scarlet Fever Symptoms are completely overshadowed by those of acute blood poisoning. In a few days the patient sinks into a state of profound collapse, and is carried off by heart failure, without having manifested any local symptoms sufficiently severe to account for his serious condition; and Post Mortem examination may reveal nothing of importance. (b) Such cases are well known to all observers, and have been variously described under such terms as Malignant, Pestartig, Fondroyant, or Toxic.

With regard to the pathology of these three forms of Scarlet Fever, it may be said that all authorities agree that the simple uncomplicated cases are clearly due to the action of the undiluted Specific poison*, whatever that may be. The Second and third forms of the disease, however, raise considerable difficulties, and various views are held by different observers. It is not disputed that in many instances there is a Septic Element involved, but as to the exact role played by Secondary infection there is great diversity of opinion. In our present ignorance regarding the Specific organism of Scarlet Fever and its peculiar properties, it is no Easy matter to distinguish the specific lesions of the disease from those due to secondary Septic processes. (c)

The occurrence of mixed infection is well recognised in many diseases of bacterial origin. (d) We know, for example, that in Phthisis Pulmonalis, a cavity formed by the breaking up of a tubercular focus in the lung becomes infested by pyogenic microbes

(a) Clifford Albutts System of Medicine v. 1. p. 832.

(b) Ditto: _____ Vol 1. p. 725

(c) Flügge: "Die Mikro-organismen". Vol 1. p. 311. (1896)

(d). Die Deutsche Klinik. Band II Vorlesung I. Bagensky. "Ueber Diphtherie + diphtheritischen Croup." page 12.

(e) "Acute Exantheme" 1896 pp. 94-98

microbes which are responsible for many of the peculiar clinical features of the disease. Again, the Typhoid bacillus favours the growth of Streptococci, Staphylococci and the Pneumococcus, - the most common secondary affections of Enteric Fever being clearly of a Septic nature [a] In the case of Diphtheria, which is a nearer analogue to Scarlet Fever, there is still some dispute as to the exact part taken by Septic organisms in producing the complications of the disease. Kanthack [b] and others [c] state that Streptococci are rarely absent in the throat both in mild and severe cases, and Kanthack is of opinion that suppurating glands, Otitis Media, Septicaemia and Pyaemia may be produced by these micro-organisms in a case of Diphtheria. It is certain, however, that many cases occur in which the most malignant lesions are produced by the Löffler Bacillus, that organism being found in an almost pure culture. Indeed the Bacteriological examination of the necrotic tissues of the throat is said frequently to exhibit a predominance of the Specific organism over all others which may be present [d]

It would seem a simple explanation to put down all complications and sequelae of Scarlet Fever to the action of Septic organisms, recognising only as Specific conditions the Symptoms observed in a typical simple case. The secondary phenomena of the disease, however, have a very intimate relation to the primary Symptoms, and it is extremely difficult to distinguish clinically those processes due to the Specific organism from those which might be attributed to the action of Septic organisms.

Jürgensen's Views

Jürgensen [e], who goes pretty fully into this question when dealing with the complications and sequelae of Scarlet Fever, suggests three possibilities in explanation of the occurrence of these phenomena 1. The Scarlet Fever poison may under certain conditions excite morbid processes in other parts of the body besides those usually affected in typical cases. 2. It may produce changes in the tissues which render them susceptible to the entrance of other disease organisms 3. It may so reduce the powers of resistance of the whole System, that it can no longer protect itself against the inroads of pathogenic microbes.

No 3

© Berliner Klinische Wochenschrift. loc. cit. pages 620. No 28. 1900 + 621

He lays considerable stress upon the results of Post Mortem examination, and is of opinion that "in all cases where pus: "formation appears, it certainly depends upon Secondary in: "vasion by Cocci, the Scarlet Fever poison being able to induce "the severest forms of Necrosis, but not pus formation." Those bad cases which run rapidly to a fatal termination, without marked local manifestations he considers as giving a "clear picture of Scarlatina-poisoning". Nephritis he looks upon as probably a result of the influence of the Scarlatina poison on the Kidneys, though in some cases pyogenic cocci alone may be the cause. The same explanation he also applies to Scarla: tinal Rheumatism. Cardiac disturbances he considers as due to the Scarlatina poison in the first instance at least, though a mixed infection may also be responsible in some cases. In regard to the lymphatic System, he believes that it becomes primarily affected by the Scarlatinal poison, but takes part in all forms of Secondary infection occurring in the disease.

Baginsky's Views

Baginsky, in discussing the clinical phenomena of Scarlet Fever distinguishes two groups of cases, according to whether the Evidences of infection or intoxication are predom: inant; using these terms in the usual sense, viz, Infection to mean multiplication of the Specific organism throughout the body, and Intoxication the local production of virulent poisons, which produce distant results through the circulation. In the latter class he includes those violent and quickly fatal forms, characterised more by severe nervous symptoms, Di: arrhoea, hyperpyrexia and Collapse, than by the presence of distinctly specific manifestations. These cases teach us, he says, that the Scarlatinal Virus can have a remote effect on all the organs, and act as a deadly poison on the heart and Central Nervous System so quickly that the microbe itself has no time to pass into the general circulation, but remains in the Pharynx and tonsils, and from thence works out its deadly influence. Along with such cases he classifies, but in a dif: ferent group, those in which the initial attack is mild, but the convalescence interrupted by such a complication as Nephritis, due to some "less toxic substance which lies deposited some: "where

(a) loc. cit. page 619

(b) Caigen "Scarlet fever" Article in Albutts Syst. of Med. Vol II p. 133.

"where in the body, perhaps in the lymphatic glands, and has "slowly developed itself." Between these two groups he places the more common intermediate forms of Scarlet fever, distinguished by local inflammatory complications, such as malignant angina, suppurating glands, otorrhoea, joint & heart affections, enlargements of Spleen and Liver, &c, &c. The pathology of these cases he explains by supposing "Infection" to be the more prominent feature, "the toxicity of the products of the "exciting agent not being severe enough to cause the virulent "symptoms of the first group; being sufficient, however, so far "to injure the organs that they are able to offer but little re: "sistence to the entrance of other microbes." The manifold complex of symptoms characteristic of these cases he attributes to a concurrence of the Septic poisons produced by local tissue destruction with the primary Scarlatina toxine.

Baginsky does not refer specially to the simple uncomplicated cases, but it is probable that he would include them in the group characterised by "Intoxication", as he takes the view that the Specific eruption of Scarlet fever is most likely due to the action of a toxin, and not of the Specific organism in the skin. It will be noted that he strongly leans to the idea that the Secondary complications may have a Septic Element in their origin, but he holds nevertheless that "Infection by "the Specific exciting agent itself is the most conspicuous and "particular." The results of his bacteriological research doubtless have a great deal to do with the attitude he takes up. He was unable to discover any difference in the organisms found in both toxic and infective cases, and could therefore not distinguish a Specific organism from one which could be supposed to be responsible for the secondary affections. (a)

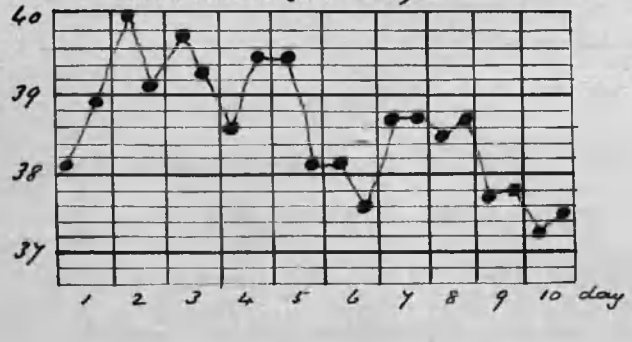
The important point however to be gathered from these very interesting views of Baginsky is (as far as can be made out from his article) that he puts a clear distinction between the pathology of the two groups of cases which he describes. This is also the position taken up by Caiger. (b) He classifies Scarlet fever cases into Simple, Septic, and Toxic or Malignant. The second class he describes as being "attended with the "gradual development of the symptoms of Septicaemia," but the third

Caiger's Views

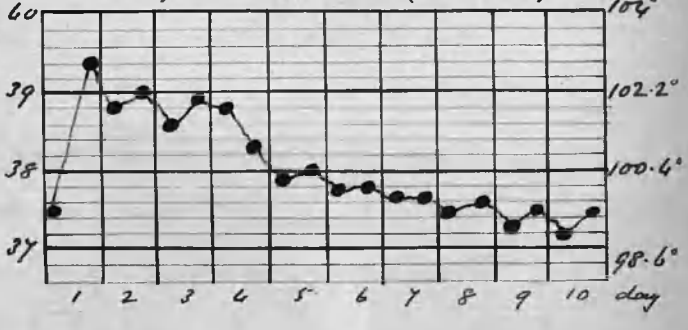
Hirsch. "Zur Casuistik des Scharlachs." Berlin 1900.

See "Jahrbuch für Kinderheilkunde". Band 52

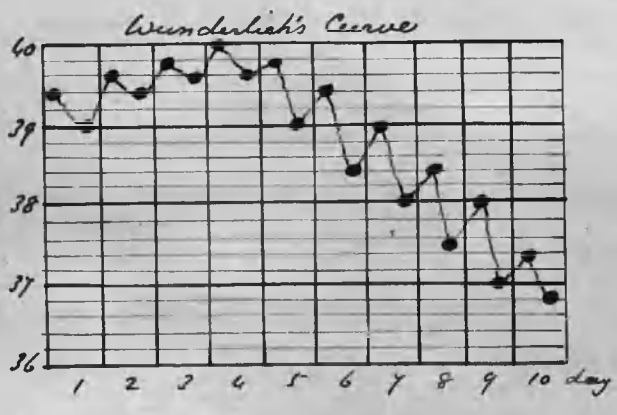
All Cases (Hirsch)



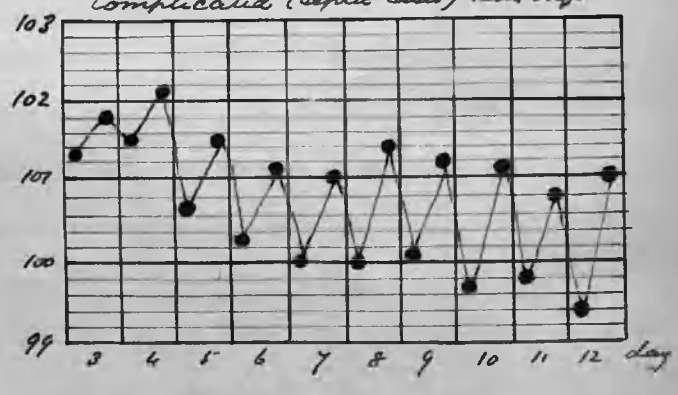
Uncomplicated Cases (Hirsch)



Wunderlich's Curve



Complicated (Septic Cases) Ruth Inf's



See also Appendix.

third class as "being struck down by the intensity of the "Scarlatinal poison." "It seems to me", he says, "more logical "to restrict the term malignant to those cases which are "malignant in virtue of the intense action of the essential "Scarlatina poison." According to this view these cases would simply be excessively severe forms of the first class, which include those characterised by the occurrence of the group of specific symptoms which give us the type of the disease, — and are entirely devoid of complications.

Temperature in Sc. Fever

A more detailed comparison of the course of the temperature in various forms of Scarlet Fever is very instructive, and gives valuable indications as to the pathological nature of the disease. Hirsch has given two very interesting charts, based upon records of 393 cases which occurred in the Berlin Charité Hospital during 1894-97. They are upon the pattern of the composite photograph, being constructed by taking the average temperatures night and morning of all cases and combining them in a single record. The first chart represents all cases, and the second simple uncomplicated cases. For comparison with these he gives the typical Scarlet Fever Curve of Wunderlich (who first introduced the measurement of body temperature). The chart of uncomplicated cases shows a sudden initial rise to 39.4 (say 102.5 Fahr) followed by a gradual lysis extending over about a week. Wunderlich's chart shows a similar initial rise, but augmented during the next three days to the extent of about another half degree, followed as before by a weeks lysis. Hirsch's chart of all cases (i.e. both with + without complications) on the other hand shows marked irregularities, the typical lysis being replaced by sudden exacerbations + remissions, due to the influence of the various complications occurring during the first ten days. He adds the remark: that Sepsis, when it is "associated with Scarlet Fever, makes its own typical curve, does "not need to be further emphasised." The charts of the various cases with complications which have already been given (see "Case Records") may be referred to in this connection; and it need hardly be pointed out how absolutely they differ from those of Simple cases and from the typical Curve of Wunderlich. The accompanying chart, constructed on the above plan, shows the average temperatures 9

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* See also Appendix

(a) Compare also: —

Twentieth Century Practice. Article Scarlet Fever. Forchheimer p. 46.

Medical Diseases of Children 1900. Oppenheim p. 393.

Gerhardt. Lehrbuch der Kinderkrankheiten 1897. Bd. I. S. 114.

(b) Berliner Klinische Wochenschrift 1900. 2 July. No 27. p 587

Baumgarten. "Der gegenwärtige Stand der Bacteriologie."

temperatures of 31 cases*, which came under my own observation, being a selected number of complicated cases from the record of 257 cases referred to in the first Section of this Thesis. The complications in these cases were:- Discharging Throats, Ears, and Noses; Enlarged glands; Abscesses; Diarrhoea; Albuminuria, & such like. With regard to malignant cases, the resemblance which their charts show to the Septic cases is strong, while their high registers and irregular course sufficiently distinguish them from the Simple typical Curve. The above chart does not include Malignant cases.

Pyogenic Organisms in Sc Fever

It will thus be seen that most authorities admit that the various complications of Scarlet Fever may have a Septic origin, or at least that pyogenic organisms may have a share in their production.(a) It is difficult indeed to avoid such an admission in the face of the results of bacteriological investigation. We have seen that in the quest for the Specific organism of the disease nothing but Streptococci & Micrococci have been demonstrable. These have not signalised themselves by any Special qualities which might not belong to other pyogenic cocci of common occurrence. If we cannot therefore yet assume that the germ of Scarlet Fever belongs to this group of organisms, it is impossible to believe that the Streptococci which abound in all the Secondary discharges of the disease are there merely by accident. We are compelled to attribute some causative relation to them. Whether they are solely responsible cannot be determined at present. The probability is that Jürgensen's theory is largely correct, viz: that all purulent conditions are more or less due to Septic infection by Streptococci, the tissues having been first rendered susceptible to such invasion by the depressing influence of the Specific organism. Baumgarten has suggested the possibility that the action of substances which must be considered as Derivatives (Abkömmlinge) of the Specific poisons has something to do with the production of the complications and Sequelae of a disease, and also with the varying mortality of different Epidemics. He admits, nevertheless that these phenomena may be due to a "peculiar mixed infection" (b). D. Gordon's recent discovery that there is a distinct modification and increase

of 9

(a) Supplement to Loc. Gov. Report 1899. 1900 pp 452. 453.

(b) Clinical Lectures on the Practice of Medicine 2nd Edition pp. 241 + 257.

(c) Compare also Forchheimer, 20th Century Practice. Art. Sc. Fever p. 68.

of virulence in the "Streptococcus Scarlatinae" denied fomfatal cases of Scarlet Fever (a) opens out a further possibility of explanation of the Septic & malignant manifestations of the disease. There is, however, nothing final in any of these views.

Pathology of Toxic Scfever.

With regard to the third or toxic group of cases, the concurrence of opinion seems to be that they are due to an excessively virulent development of the Specific virus of the disease. It is remarkable that this is the opinion held by Graves as long ago as 1834. In describing the Epidemic of that year, he speaks of certain rapidly fatal cases, characterised by violent nervous symptoms as being probably the result of "an intense poisoning of the system by the animal miasma of the Scarlet fever", there being no lesions which could be detected after death. (b) It will be observed that great stress is put by all authorities upon the absence of distinctive lesions in such cases, and this is supposed to indicate the exclusion of any Secondary Element. There are many objections, however, to this view. If we are to consider Scarlet fever to be an essentially specific morbid process, due to a germ or poison which is distinct from all others, we are only justified in attributing specific symptoms to the action of that poison. The simple uncomplicated case gives us the type. The malignant case is certainly the form which deviates furthest from the type. It is in many instances hardly recognisable as the disease at all, the rash being absent or Quite anomalous, and the throat little affected, and it is only diagnosed as such by its association with other clearly marked cases of Scarlet fever, or its occurrence during an Epidemic. Moreover, it is a rare thing for a simple case to develope fatal malignancy. Such a termination is much commoner in "Septic" cases. Indeed "Septic" and "Toxic" cases differ much less from oneanother than each does from the simple case. There are instances, (c) as we have seen, where patients suffering from a simple attack may be very ill indeed, and show all the Evidences of an intense development of the Specific poison in a great aggravation of the typical Symptoms, the rash being intensely bright and widespread, the pulse extremely rapid, and the fever

very

"It is undoubtedly possible that the so called septic and
"malignant forms (of Sc. fever) are merely ordinary cases
"of Scarlet fever plus a varying but always severe
"invasion of one or more varieties of Streptococcus. The
"more one sees of these cases ..... the more is one con-
"vinced that they make a picture, not merely of a
"severe eruptive fever, but also of a Septicaemic or
"pyaemic disease grafted thereon."

Oppenheim. Medical Deseases of Children 1900 p. 393

very high. Such cases may even be fatal in a delicate subject. They are, however, absolutely distinct from the so-called malignant forms. The latter rather resemble the more acute varieties of Surgical and puerperal Septicaemia, which are characterised by the same evidences of profound poisoning of the vital centres, and are frequently devoid of local developments severe enough to account for the symptoms. It may rather be that in malignant Scarlet fever we have to do with a mixed infection by some excessively virulent organism, which, in the presence of the Scarlet fever virus is able rapidly to evolve its deadly influence upon the whole system. (Symbiosis). Those who hold that malignant Scarlet fever is due to the intensified Specific virus give no explanation of the rapid increase in the virulence of the poison in an individual case, and of the fact that malignancy may occur from infection by a simple case, and during Epidemics of a mild form of the disease. (a)

Summary of Pathology of Sc fever

It may be said then, in conclusion, that as far as our present knowledge goes, we are justified in believing that Scarlet fever is a disease due to some Specific Organism, which in the majority of simple cases, acts alone. Owing, however, to the peculiar depressing influence of the toxines produced by this organism in the system, as determined by constitutional susceptibility &c. the blood and tissues are rendered liable to invasion by all manner of Septic and pyogenic microbes of varying virulence. When this secondary infection occurs, it usually manifests itself in purulent conditions of the throat (Diphtheroid) and upper air passages, the presumptive seat of Entrance of the original infection of Scarlet fever. At other times remote parts such as the Kidneys or Joints may be involved, and exhibit inflammatory lesions, the severity of which being probably determined rather by the peculiar nature of the injury inflicted on the tissues by the original Scarlet fever poison, than by any special qualities attached to the secondary Organisms. Finally, the casual association of some virulent organism with the Specific organism of Scarlet fever, occurring at

at some favourable juncture Early in the history of the case, or it may be at the moment of primary infection, and in a susceptible subject, may lead to the development of violent toxic symptoms, and rapid involvement of the Central Nervous System and vital organs, ending in death before there has been time for any local or specific phenomena to declare themselves. The severity and danger of Scarlet Fever is therefore in a great measure proportional to the predominance of Secondary Infection. This is the great factor to be taken into account. The specific organism is in itself apparently a comparatively innocent agent; and were it not for its frequent evil associations, would be an object of little dread. How far it is responsible for some of the secondary complications of the disease is doubtful, but it is certainly not to be blamed for the severe Septic and toxic conditions which have been referred to. On the other hand there is no question that many common pathogenic microbes, settling upon the tissues of a Scarlet Feverpatient, find there all the necessary conditions for the full development of their worst propensities.

Classification of Cases

On the lines above sketched some such classification of Scarlet Fever cases as the following might therefore be Suggested:—

I. Simple or Rudimentary Forms:—

(a) Mild Typical attacks.

(b) Severe or excessively developed forms, characterised by increased development of the normal Symptoms.

II. Complicated Forms:—

(a) Septic Scarlet Fever. Showing marked local inflammatory lesions due to secondary Streptococci invasion.

(b) Toxic or Malignant Scarlet Fever,— probably due to a mixed infection by virulent organisms, there being a rapid evolution of powerful toxines with a special predilection for the Nervous System and the vital centres, resulting in a fatal issue before local Symptoms have time to declare themselves.

Return

* Cf. recent correspondence in Lancet on the value of Isolation Hospitals in Scarlet fever, & especially Lancet leading article of 9th Feb 1901 criticising Wm Marriott's (of Nottingham) views.
Cf. also, Criticisms on Millard's paper on this subject read to the Society of Med. Officers of Health. Lancet 16 Feb. 1901.

"Return Cases" &c

The important and difficult question of the Etiology of "Return Cases" of Scarlet Fever has within the last few years been the subject of very exhaustive research. It is found to be the experience of all Fever hospitals that, despite the most careful precautions in dealing with patients who have suffered from infectious disease, it is impossible always to prevent them carrying infection to other individuals after their discharge. It is true, as will afterwards be seen, that genuine "Return Cases" are really very few indeed, and it would be absurd to use them as arguments against the value of isolation hospitals.* Still, they exercise an unfavourable influence upon the mind of the public, and are very apt to give rise to complaints and even actions at law against the officials in charge of such institutions.

During the height of the Scarlet Fever Epedemic in Perth in 1898, the Infirmary was charged by the County Medical Officer of Health with giving rise to seven Return cases in various parts of Perthshire, by having discharged patients in an unhealthy condition. The subject was carefully enquired into, however, and we were able to prove that as Hospital officials we were entirely without blame, the patients having been found free from desquamation and discharges before dismissal, and that the Return cases referred to had probably arisen from imperfect disinfection by the County Authorities of the childrens' clothing, which had all been left at home and never been near the Infirmary. This is an example of how such complaints are often entirely without foundation, but proves how readily outsiders may originate false reports against a public Institution.

When is a patient fit for discharge?

In considering the subject of Return Cases more in detail it is important to remember the questions to be solved by those responsible for the discharge of fever patients from hospital, in view of the danger of such cases being laid to their charge. The chief difficulty is to know when a patient

:tient ceases to be infectious and in a safe state to mix with other susceptible individuals. This resolves itself into the question as to the infectious nature of desquamation & chronic discharges, because these are the two prominent symptoms which continue to manifest themselves during convalescence. If these conditions were of definite duration the difficulty would be insignificant, but it is unfortunate:ly the case that they are often very tedious and persistent. In coping with extensive epidemics ward space is frequently taxed to the utmost, and it becomes imperative that pa:tients should be sent out the moment they are ready, to make room for fresh cases. The question arises, as to what is to be done with children who linger on in hospital with scurfy skins, and running Ears and Noses, which seem to defy all treatment. Such patients often amount to a fair proportion of the cases in a ward, and become a genuine encumbrance. Are they likely to be sources of dan:ger if allowed to return in such a state to their homes? Or do they remain infectious till their skins are whole, and their discharges dried up,—a matter often of many weeks or months? Or, on the other hand, are these disabilities merely a sign of impoverished health, and the sooner the patients are removed from the sickly atmosphere of the Fever-house the quicker will they throw them off? We are compelled to believe that the Scarlet Fever poison does not remain permanently in any individual, however long his con:valescence may be. But whether it ceases to be discharged when the skin has all been shed, and the mucous mem:branes have become healthy again; or whether these events have really nothing to do with the cessation of infectivity, are questions which are deeply interesting to all the Officials of a Fever Hospital, and loudly demand a conclusive ans:wer in view of the conservation of the public health.

Mode of Spread & Infectivity

Before going further it will be necessary to consider the peculiar mode of Spread and infectivity manifested in Scarlet Fever, and it must be kept in mind that the dis:ease can only be communicated from a sick to a healthy subject through certain well defined channels of infection.

The

(a) "Die Krankheit ist schon ansteckend gegen Ende der Incubation"
Gerhardt. Lehrbuch d. Kinderkrankheiten 1897. Band I. S. 114.

(b) cf. Klein's researches

(c) "In order that Scarlet fever can be transmitted immediately
"the contact must be quite close, such as kissing, touching, in-
"haling the breath, direct contact of the mucous membrane of
"the throat with the virus." Forchheimer. loc. cit.

(d) Compare Jürgensens remarks. "Acute Exantheme" p. 42. 43.

The chief of these is undoubtedly that of aereal convection, taking place principally during the early stages and at the height of the attack. Some authorities consider infection to be possible even towards the end of Incubation.[a] It may also be carried by fomites, by infected milk Supply, and (Questionably) by certain of the lower animals suffering from some disease corresponding to human Scarlet fever.[b] That it is not commonly spread by water or food, & that it does not arise from "bad drainage", damp, or such like sources of popular dread, is now well established. The infectious nature of desquamated particles of skin has long been held by medical authorities, and the danger of discharges from mucous surfaces is being more and more insisted upon; but these two subjects will be discussed by themselves in dealing with the question of Return Cases.

Aereal Convection

By aereal convection is meant the conveyance of the disease from the sick to the healthy, during the common intercourse of social life, without any necessary contact of person, or any apparent transference of morbid material from one to another, but simply from sufficient proximity of sick to sound as to permit of their breathing the same air during a limited period of time. The fact that the disease so readily spreads in densely populated districts, in over crowded houses, in schoolrooms, in public conveyances and such like is Evidence of the importance of this channel of infection. Some hold that contact must be quite close for transmission to take place[c] but it is difficult to believe that this is always necessary. The exact mode in which the contagium is conveyed is certainly a matter of some obscurity.[d] It is probable, however, that the breath is responsible to a large extent. Recent research tends to confirm this old and well established opinion. We know from careful experiment that, although in quiet respiration no bacteria or other morbid products are contained in the expired air; yet not only in coughing and sneezing, but also in speaking and even whispering, minute drops of vapour containing germs may be carried from the air passages into the remotest corners of even large rooms by means of the ordinary currents of air, and in this

way

(a) Untersuchungen über die Frage der Tröpfchen-infection Kaniger. Zeitschrift für Hygiene + Infections Krankheiten vol 34. 1900. page 119.

Cf. also. Dunitz. Deutsche Klinik, Art "Die Infection". p. 51.

Newman "Bacteria" 1899. Section on Bacteria in the Air

Kanthack. Albutts Syst. of Med. vol 1. page 543.

(b). Caiger calls attention to a fine peach like powdery bloom on the face as early as the 2nd day (loc. cit)

Hirsch (loc. cit) has noted desquamation in a number of cases on the third day, chiefly about the neck.

(c) See further on.

(d) Albutts System of Medicine vol II p. 129.

Forchheimer. Twentieth Century Practice vol XIV. p. 15.

way lead to the spread of infection (Tröpfchen-infection).[a] This has been demonstrated in the case of Tuberculosis and Influenza, and there is no reason to doubt that the same obtains in Scarlet Fever. It is also a well known fact that from dry surfaces the slightest movement or current of air will raise myriads of bacteria; and if it is the case that the skin contains the Scarlet Fever Virus, it is quite conceivable that during the acute febrile stage of the disease, when the skin is hot and dry and beginning to desquamate about the face,[b] the patient being at the same time restless and breathing more rapidly than usual, all the necessary conditions are present for the dissemination of infectious material. The drying of small particles of mucus and other discharges about the lips and nose, and on the bed clothes in the neighbourhood of the patient must also be taken into account. The infectivity of the disease is difficult to prove during the period of prodromata, but it is undoubtedly well marked at the height of the fever and eruption, and at this stage there is hardly any other source of infection imaginable than what has been mentioned. It must be added, however, that the part played by desquamation in the spread of infection is at present a question of considerable discussion, and still seems far from a satisfactory conclusion.[c]

Limits to Spread of Contagium

There is one peculiarity, however, about the contagium of Scarlet Fever which robs it of a large share of its danger, and that is the fact that it is apparently incapable of penetrating walls or fissures between rooms, nor will it readily spread from one section of a house to another, and certainly never from one house in a street to a neighbouring one, by pure convection. This is strikingly illustrated by the fact that fever hospitals have so seldom been blamed for the outbreak of Scarlet Fever in any district, however susceptible.[d] The Fever house of the Perth Infirmary is in close proximity to a large day school, and the children play about within a few yards of a wardful of patients in all stages of the disease, and yet an outbreak has never been traced to this influence. Further than this, the wards referred to are in the same grounds, and connected by passages

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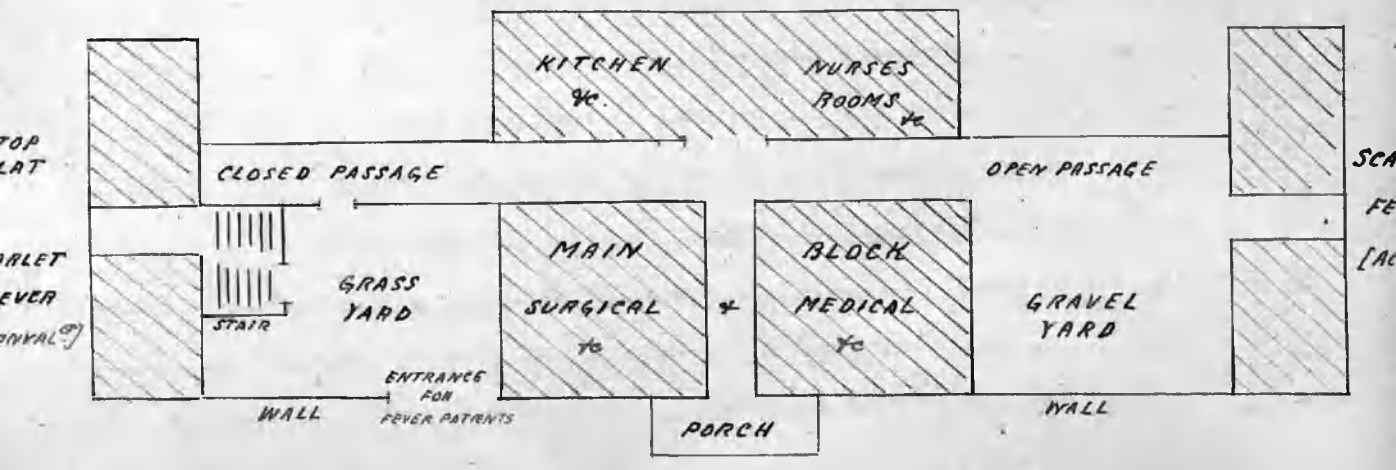

Rough Sketch of Ground Plan of Perth Infirmary, Showing the Connections of Fever Wards with the Main Block.

(a) Supplement to Local Government Report 1894-5. pp. XVII + 103

(b) Ditto: _____ 1896-7 pp. XXIV + 263.

passages with the medical and surgical wards and the living rooms of the Staff, (See opposite), and yet an outbreak of Scarlet Fever in the general Section of the Infirmary, either amongst patients Servants or nurses, has never been known in the course of many years. It would seem that free admixture with atmosphinic air and probably the influence of sunshine are capable of rendering the contagium of Scarlet fever inent, and that the spread of the disease is determined chiefly by the conditions of human intercourse

When we come to consider the question of desquamation, and especially that of discharges, we have to deal with a palpable material visibly emanating from a patient, and the presumption is strongly in favour of these being dangerous sources of infection. And, indeed, it may be said, that most authorities agree that this is the proper view to take of the subject. The relative degree of infectivity of desquamation and discharges is however still a matter of considerable discussion, and as this has an important bearing on the question of "Return Cases," it will be necessary to examine the views held by those who have recently been engaged in the investigation of this subject.

Loc. Gov.t Enquiry

It is only within the last few years that the practice of removing Scarlet fever patients to Isolation Hospitals has become largely prevalent. The occurrence of "Return Cases" has therefore only recently come to be an appreciable difficulty. The subject was first brought under the notice of the Local Government Board in Jan.y 1894, when a conference was held and minute enquiries instituted; but it was found to be too complicated to admit of definite solution at the time. The only suggestions made were that all overcrowding of hospitals ought to be avoided, and that more perfect arrangements for disinfection of houses should be adopted by the Sanitary Authorities. The problem was afterwards taken up by D.r Klein in great detail, but was found both difficult and tedious. He set about making an exhaustive bacteriological study of the desquamated skin, the urine and the secretions from the throat nose and Ears

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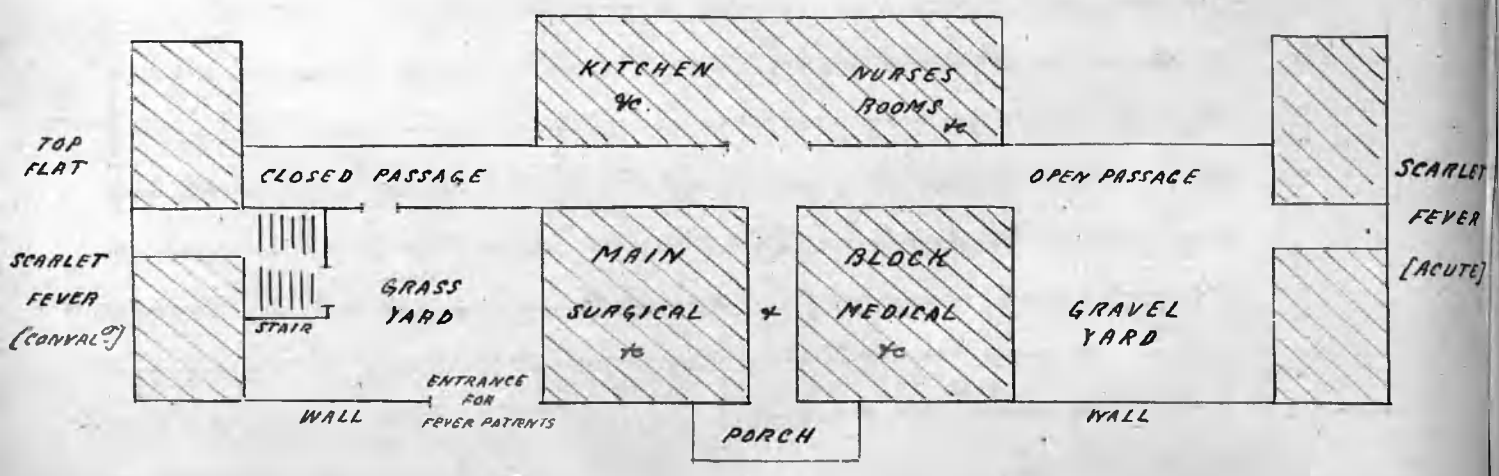

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of

(a) British Medical Journal 1898. Vol ii p. 614 &c

(b) Metropolitan Asylums Board "Return Cases of Scarlet Fever & Diphtheria" Reports & Papers relative to the Boards Enquiry. (Pamphlet) · 1901

of patients at all periods of the disease. In his report he states that "at no stage of the disease could he detect in the cast off "cuticle any microbe which could be thought of as having con: "cern in its spread; the like being true of the Urine." The results of his examination of the secretions have been already referred to in connection with the Etiology of Scarlet Fever. The fact, however, that neither the Streptococcus Scarlatinae of Klein, nor any other allied microbe has as yet been proved definitely to be Specific for the disease, forms a very serious deduction from these conclusions, and indeed renders any enquiry into the cause of Return Cases on bacteriological lines quite inconclusive. Of more practical value are investigations undertaken from a strictly clinical point of view, some of which we shall now proceed to examine.

Millard's Researches

The very exhaustive researches of D^r Millard of the Birmingham City Hospital first claim attention.[4] He has tabulated the results of an enquiry into the conditions deter: mining the occurrence of 171 Return Cases out of a total record of 4810 patients that passed through his hands during the course of 2½ years. In his Report he descusses very fully the Question of desquamation in relation to its infectivity. In doing so he has occasion, as he says, to mention "certain considerations "which rather point against the scientific correctness of the old "and accepted view." The most important of these is the fact already referred to that Scarlet Fever never seems to be carried by the fine scales of Epithelium, though these are undoubtedly spread by currents of air into surrounding neighbourhoods. He also points out that we have no positive evidence of any kind that desquamation is in itself a source of infection. He mentions further that evidence is accumulating that late and especially secondary peeling is not a source of appreciable danger.

Simpson's Researches

Similar views to these are held by Professor Simpson in his recent Report to the Metropolitan Asylums Board on Return Cases of Scarlet Fever.[6] He investigated into the causes of 90 Such cases occurring amongst 6507 patients treated in the Hospitals of the Board, during a period of six months (see Pamphlet pages 14+15). He states that "though Desquamation of "the skin is usually considered to play an important part "in

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(a) This case was shewn at the current meeting of the Local Branch of the British Medical Association for Perthshire

"in the spreading of infection, in this enquiry only 2·7 p.cent of the cases could be attributed to this cause." (page 15)

Prolonged Desquamation

Referring to the subject of prolonged desquamation, the extraordinary persistency sometimes exhibited by this condition is well illustrated by some cases which came under my own observation. It may be said that it was the rule in the Perth Infirmary, as it is in all well regulated Institutions, to discharge no patient until this process is complete, unless under exceptional circumstances. We usually found this to be the case within about 8 weeks, the average duration of stay of our patients being 55 days (excluding fatal cases and those detained for specially long periods owing to tedious skin conditions & other causes). We found it necessary however to keep many children much longer than this on account of a peculiar scurfy condition of the skin which in some instances was very persistent. One child was detained 77 days, another 97 days and two for nearly 15 weeks. These latter were eventually discharged very much in statu quo, as all treatment seemed to be hopeless. It would appear that an evil habit of desquamation was set up in such cases, and its extreme pertinacity was seen in the case of a boy who was kept in hospital for 14 weeks on this account, and after being discharged at the urgent request of his friends, turned up at the Out door Depart. Eight months afterwards with his hands and feet still covered with small blisters of desquamating skin. On Enquiry was made of this child's mother, who stated that he was in the habit of amusing himself with picking off the skin from his hands, but during all the Eight months he had freely mixed with other children, none of whom had taken Scarlet Fever. There is no doubt that the rough skin of the hands and especially the feet of the poorer class children, - who frequently run about without shoes & stockings, - is very likely to acquire a dry scaly condition. This may in many cases be permanent, and exist before as well as after an attack of Scarlet Fever. It would be wrong therefore to maintain that these children remain a source of infection on account of their Skin, after the main primary

ⓐ Berliner Klin. Wochenschrift. No 28. 1900. Page 620

primary desquamation of the disease has occurred.

Infectivity of Shed Skin

Any conclusion as to the real infectivity of the Scales of Epithelium shed by Scarlet Fever patients is complicated by the difficult question referred to by Millard as to whether the Scales actually contain the Specific contagium, or merely act as fomites, carrying infection from their having been in contact with a diseased individual, & being impregnated perhaps by germs shed from the breath or by particles of dried secretion, much in the same way as clothing, letters, books, and such like articles may become contaminated & act as carriers of infection. Whether such a distinction is really admissable or not, it would be difficult to say; and from a practical point of view it might appear at first sight of little consequence in what way the contagium is attached to the shed skin. But the question has distinct importance in reference to protracted or Secondary desquamation. If it is possible to prove that the shreds of cuticle do not necessarily contain the germs of Scarlet Fever, then there will be a strong probability in favour of the view that the period of infectivity of a patient is not co-extensive with that of his desquamation, and there will be some hope of getting rid of the bugbear of tedious Skin conditions as a source of infection. This however is one of the points which can only be finally settled when the specific germ of Scarlet Fever is discovered.

In this connection reference may again be made to the suggestion of Baginsky that the rash, & consequently the desquamation, are not really due to the local presence of the specific organism in the skin, but are the results of toxines in the blood, - the rash thus being analogous to that produced by certain drugs, such as Belladonna, Antipyrine & others, and by Diphtheria Antitoxine, where of course no germs are present. @ If this were the case the Scales of epidermis would not be infectious in themselves. We have certainly but little evidence in the case of those infectious diseases whose bacteriology is confirmed, that the Skin and its secretions ever contain specific organisms; and there is thus no presumption that this is so in Scarlet Fever.

(a) Muir + Ritchie consider this point still a subject of dispute
[Manual of Bacteriology. 1897 p. 312]

(b) British Medical Journal 25 Sept. 1897. p 765-6

fever. all that can be said is that the opinion is held by many that in Typhus, Measles, and Smallpox, the infection may sometimes be spread from the skin, but in these diseases there is no bacteriological proof available. It is said that the Typhoid bacillus has been found in the red spots which occur in that disease (a), but this gives little help, as no one can contend that Typhoid fever is ever spread by desquamating skin.

Everything being taken into consideration, the practical inference is that we are not yet in a position to ignore desquamation as a possible source of infection, and if a patient suffers from no other disability, a smooth skin is the best criterion still available in a simple case, that he is now free from infection. It is probably the practice in all hospitals to make this the test, where there are no complications to take into account. It is usual, however, to fix a minimum period of detention in hospital to make sure that no mistakes occur, and this is a good precaution. This period varies from four to eight weeks in different hospitals. In the Perth Infirmary only a very few patients were discharged before six weeks isolation was completed,- dating from the commencement of the illness. Reech is of opinion that six weeks is too short, and suggests Eight. (b) It is probably the fact that the majority of cases, even simple ones, require Eight weeks absolutely to complete peeling. There is in short no evidence as yet to warrant any reduction of the minimum period of Quarantine, and though six weeks may be a safe enough limit in mild uncomplicated cases, there is much greater security and no danger to most patients in adhering to the longer period of isolation. One point, however, has certainly been brought out by the researches of Millard and Simpson, viz, that we need no longer worry over scurfy and blistering conditions of the skin, especially of the feet, persisting after the primary desquamation is completed. Millard says emphatically "I feel satisfied that desquamation "confined to the feet, or occurring long after the process of des- "quamation on the body generally has been completed, is no "source of danger." It is of course necessary to send out patients

Length of Quarantine

patients as far as possible with whole skins; but to retain a child for an indefinite period because his feet are still unsatisfactory is apparently unnecessary. All who have had to do with the discharging of fever patients will realise what a relief it is to be assured on this point.

Chronic Discharges

With regard to the question of Discharges, we have to consider those due to congested, and, it may be, ulcerated conditions of the throat, often associated with enlarged glands and more rarely with chronic Abscesses. We have also to consider Rhinitis and Otorrhœa, which are very common Sequelæ of Scarlet Fever, and the less important Eczematous skin conditions, besides such minor troubles as sores and chaps about the face and hands and feet. The relative frequency of these complications varies with the character of the Epidemic, and their persistency and amenability to treatment also show great differences. In the Epidemic in Perthshire referred to, out of 257 cases, discharging throats were noted in 16 patients, running Ears in 19, Rhinitis in 12, and minor ailments such as Blepharitis, Conjunctivitis and unsatisfactory Skin conditions in 12 cases. These figures refer specially to chronic discharges giving trouble during convalescence.

As regards the infectivity of these Sequelæ of Scarlet Fever the opinion of recent investigators is unanimous, the tendency being to look on them as even more dangerous than desquamation. Millard (loc. cit) finds that "Chronic "Rhinitis far more than any other lesion tends to carry "infection," and that it is "in the nasal cavities where the "organism of Scarlet Fever most readily finds a lodgement "in those cases where infection is unduly prolonged." He is also firmly convinced of the highly infectious nature of all cases of Otorrhœa, and was in the habit of retaining them for at least thirteen weeks. D. Reece @ is also of opinion that purulent discharges from the nose, Ear, or a running sore are infectious beyond a doubt. The most important evidence, however, is that of Professor Simpson, given in the Report already referred to. He found that

(a) D. Simpson's figures are as follows: See table p. 15 of Report:–

	cases	
Discharge from Nose	36	= 69 in 90 cases = 76.6 p. cent
do from Nose & Ears	13	
Colds in Head	15	
Colds in Chest	5	
Sore Nose	5	= 12 in 90 cases = 13.3 p cent
Unhealthy throat & swelled glands	7	

(b) Compare an interesting article on "The Utility of Isolation Hospitals in diminishing the spread of Scarlet Fever" in Journal of Hygiene Vol 1. No 1. especially page 152.

that over 75 per cent of discharged patients who were proved to have spread infection suffered from discharges from the mucous membranes chiefly of the respiratory tract, and 13 per cent showed an unhealthy condition of the throat and nose. (a)

Comparison of Millard's & Simpson's Results

With regard to the whole question of Return Cases, these conclusions are of great interest and importance. Dr. Simpson's results are doubly valuable on account of the scrupulous enquiry which he made into all doubtful cases, and the care with which he excluded all other sources of infection, so as to be absolutely certain that he was dealing only with genuine "Returns," due to the personal infectivity of the primary case discharged from hospital. His percentage of such infecting patients is 1·3 upon a case record of 6,507 discharges, 90 patients giving rise to "Returns," allowing a month as the limit of time within which cases were considered as "Returns". Comparing these figures with Millard's who gave six weeks as the limit, we find the percentage which he arrived at to be 3·4 infecting cases, or 158 patients out of a record of 4,810 discharges. It may be said in passing that these results show how very small indeed is the danger of infection from patients discharged from competently administered Fever Hospitals. Even if we take Millard's figures they are not to be considered as indicating any risk to the public from such a source, to be put for a moment against the dangers of treating such a disease as Scarlet Fever at home. (b)

The practical inferences to be drawn from the investigations referred to are of considerable importance to the Hospital official as well as to the private Practitioner. They have special reference to the duration of Quarantine and the treatment of Convalescents. In the first place, it is plain that, within certain limits, mere length of isolation is considered to have comparatively little to do with the continuance of infectivity. Millard found that Early discharge did not lead to the largest number of Return Cases, nor did long detention completely eliminate them occurrence. The same conclusions

(a) Memorandum to Report. pp. 45 & 46

(b) In connection with the question of the infectivity of Discharges after Scarlet Fever, the Roy. Coll. of Physicians, at the request of the Met. Asylums Board, have issued a Recommendation that certain wards should be set apart for patients suffering from such discharges & after careful treatment the results watched for return cases or otherwise after their dismissal. vide Lancet 23 Feb 1901.

clusions are arrived at by Simpson who is strongly of the opinion that the largest number of primary infective cases are amongst those that are detained longest in hospital. He gives examples of three children, who after being under treatment respectively for 240, 147 and 129 days were found to have infected others on their return home. These cases suffered from discharges from the nose and Ears. In attempting to account for the prolonged infectivity of which such are examples, he states his belief that it does not belong *per se* to the patient, but is attached rather to his surroundings, and becomes "engrafted on the patient." Chronic discharges such as Otorrhea and Rhinitis, he says, do not appear to possess infectious properties of themselves, but become infective by accidental contamination (page 17) He cites four cases, all of which had been in hospital for more than eight weeks, where discharges starting after dismissal proved to be non-infectious. Further he has found evidence that in many cases the infectiousness of a patient does not continue long after his return home, though his discharge may continue.[a] This means, in short, that after a certain period of time, nothing is gained by keeping a patient in hospital with the object of healing a chronic discharge.

It will be admitted, as Dr Simpson says, that the Evidence is too small on which to build such a theory; and the Metropolitan Asylums Board have done well to recommend further investigations on this point.[b] In the meantime these views of his have an interesting bearing upon the value of Convalescent Homes in the treatment of Scarlet Fever. If we have simply to send patients direct out of a general ward, where all stages of the disease are kept, then it is of little importance whether their discharges are primarily or secondarily infective, the danger remains the same. But if Simpson's theory be correct, then the great advantage of removing children who suffer from such complications to some fresh ward or Convalescent Home before finally sending them out amongst their fellows again, is at once apparent. Unfortunately Dr Simpson's experience with regard to such recruiting places does not support

Convalescent Homes

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support the usual conception of their utility in this direction. He finds "that they do not share any greater immunity "from primary infective cases than the other hospitals." (page 20). As is pointed out, however, by several of his Critics, this is an unfair comparison, because these Convalescent Homes are naturally shackled with a greater proportion of the very cases which are likely to be most infective.

Fresh air in treatment of Sc. fever

It would indeed require very strong evidence to throw doubt upon the advantage of removing convalescent patients from close proximity to acute cases in overcrowded wards to the fresh air of the country, in promoting their complete recovery. In fact, this seems the only way out of the difficulty of knowing how to deal with such patients. There is no question that the prevalence of chronic discharges is largely due to a low condition of the general health, apart altogether from their repeated re-inoculation with contagium. Post-Scarlatinal debility can only be properly treated by removal into a pure atmosphere, and by free exposure to sunshine and hill or sea breezes. These are far more potent disinfecters, after all, than syringes and antiseptic lotions. In fact the long continued use of such appliances often tends to keep up a chronic state of irritation from which a child may take months to recover even after returning home. Our experience in Perth was distinctly in favour of Convalescent Homes. During the height of the Epidemic an uncomfortable state of overcrowding took place in the wards, and this was obviated by the erection of a temporary wooden Hospital on a hillside some two miles distant in the outskirts of the town, to which relays of patients were regularly drafted, as they were found fit for removal. Besides affording the most welcome relief to the congested state of our wards, and thus benefitting indirectly the cases left behind there, the change to the country did a vast amount of good to the patients themselves, and most undoubtedly hastened their recovery. There is no question that the proper treatment for the chronic illhealth following Scarlet fever is by removal to fresh air, if possible in the country. If this is impracticable, then

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then the necessity for Convalescent wards in a hospital is imperative, where at least those patients who are recovering can be kept apart from the acute cases. The use of such wards, combined with careful antiseptic treatment of discharges, tonics, and good diet, are the best means of promoting the complete elimination of the poison of Scarlet Fever from the system, and obviating the occurrence of Return Cases. This, we think, is amply borne out by the researches to which reference has been made.

Treatment

Treatment:—

The following was the routine treatment for ordinary cases of Scarlet Fever, adopted in the Perth Infirmary.

Intimation having been received that a case was expected, a nurse made ready and went with the Ambulance to the house to remove the child. If possible, the child's clothing was all left behind, to be disinfected by the authorities in the usual way; but if this was not practicable, any clothing brought with the child was taken away at once, and afterwards put through the large Steam Steriliser belonging to the Institution. A careful note was taken in a book kept for the purpose of the condition of the child and all particulars regarding its clothing; these precautions being found necessary to obviate against any complaints of Return Cases being raised against the Infirmary.

Routine Treatment

On arrival at the Fever Wards the child got a warm bath and was put at once to bed, receiving a mild febrifuge draught every few hours if the temperature was at all high, along with a laxative for the bowels if they had not already moved of themselves. Nothing but milk was given till the temperature became normal, which generally occurred in about a week or ten days. The throat was swabbed daily with saturated solution of Borax or Boracic Acid in Glycerine; or sprayed with weak Silver Nitrate, Lactic- or Sulphurous Acid The child was usually kept in bed for at least a fortnight. After desquamation had commenced the skin was rubbed daily with weak Carbolic Oil, and the child allowed to go about till desquamation of the body had well nigh passed off. The Carbolic Oil was then stopped and while regular bathing was continued, attention was now specially directed to the feet and hands. These were soaked every day in hot water and soft soap with a small admixture of Carbolic, and hard shreds of skin carefully scraped or pared off by the nurse by means of a blunt pen knife. Sometimes a small piece of pumice stone was employed where hard masses of Epi: dermis adhered to the soles of the feet. The use of too strong or irritating Lotions or Soaps in treating the skin during con: valescence

* "Clinical Medicine" 1862. Page 196

valescence is to be avoided, and no sharp instrument ought to be used in scraping off hardened cuticle. It is well, indeed, to leave the process of desquamation as much as possible to nature, ill advised efforts to loosen the skin having an undoubted tendency to cause irritation, and defeat the End desired by setting up Scaly and eczematous conditions.— It was distinctly noticed that where the skin peeled very rapidly and in large flakes, the result was much less satisfactory than where a finer desquamation occurred,— the former cases almost always requiring a longer detention. This, however, may have been due to the initial severity of the rash, leading to a more violent desquamation. There is no doubt also that in such cases the new skin formed beneath is less healthy, and being softer, more readily tends to break down and desquamate a second time.

Precautions taken as to discharge

The routine of bathing and scrubbing of feet, and general attention to health was continued until the child was considered to be ready for discharge. It was then presented for inspection, and was first of all examined by myself as House Physician, the most scrupulous attention being paid to the condition of the soles of the feet, & palms of the hands, the throat, nose and Ears, & the other mucous surfaces. The child was then finally seen by the Visiting Physician, and if found in a fit state of health was passed for discharge. It then received a complete warm bath (with slight admixture of Carbolic) and was transferred to a side room, where it was dressed by its parents, who had been meanwhile sent for. The child's clothing was either brought direct by them from home, or if already in the Infirmary was handed back after careful disinfection.

With regard to the commoner complications, the following simple methods were adopted:— for running Ears, daily syringing with Boric Lotion, and the dusting in of Iodoform if the discharge had any tendency to foetor; for chronic enlarged tonsils, Tinct of Iodine in Glycerine of Carbolic Acid. For severe throat conditions, acting on the old suggestion of Sir Wm Gairdner* I employed the steam kettle to a large extent, and with obvious benefit. Sometimes the steam was medicated with Tinct

* "In Scarlet-fever-Sepsis we experience at the present day
"what was familiar to the Surgeons + Gynaecologists before
"the time of Antiseptics. We are powerless, once this condition
"has ensued; while we are also hardly in the position to be
"able to avert it". Jürgensen. Acute Exanthems.

Tinct Benzoini Co or some Antiseptic. The general routine of swabbing and spraying throats, and douching noses was in charge of a capable nurse; all strong or poisonous applications, however, being only employed by direct instructions from myself or the visiting Physician. For swelled glands, no external treatment was usually required, except to protect them from cold or injury by a slight covering of cotton-wool. Painting with Iodine or poulticing were not favoured. When very chronic, Iodide of Lead or Ichthyol Ointment was tried. If fluctuation declared itself, and the pus seemed not too deep, an incision was at once made; the case being afterwards treated by careful draining and antiseptic dressings.

Where there was any symptom of true Diphtheria being present, the throat showing distinct membranous exudation, a portion of the membrane, or a swab of the throat was sent off at once to the Roy. Coll. of Physicians Laboratory in Edinburgh, or to Burroughs & Welcomes for a Diagnosis,—a full dose of Antitoxine being given in the meantime. In more than one case the diagnosis was positive,—but our cases of true Diphtheria, complicating Scarlet Fever, gave no special trouble, being all very mild and readily yielding to antitoxine treatment.

Septic & Toxic Cases

Antistreptococcic Serum was tried in one case of severe Septicaemia, with secondary Septic rash, but was quite unavailing, death occurring a few days after; no mitigation of the Symptoms being noticeable. It was found, unfortunately, to be the case, that the severe Septic and Toxic forms of Scarlet Fever were utterly beyond being influenced by any remedies at the disposal of the physician or the nurse. The steady downward progress of such cases, in spite of the most laborious efforts, carried on both day and night, is a painful and disappointing spectacle. We believe this is the experience of all physicians.* It is quite unnecessary to enter into the details of medication and nursing. All that can be said is that we are bound in duty to our patients to employ all the means in our power to mitigate the severity of the Symptoms

:tions at least, if we are conscious that we can do nothing to finally stay the fatal issue.

Acute Nephritis with Oedema was treated in the usual way with hot packs, &c. Chronic Albuminuria was found in a few cases to be very persistent. Reference has been made to one patient who always developed the Symptom on rising from bed. There was nothing for these cases but prolonged rest; and eventually, when desquamation was concluded, removal from the depressing air of the Fever House to the medical wards, or the Convalescent Home. Codliver Oil, Iodide of Iron and other general tonics were found of great help; all drugs such as Perchain, Salic or Tannic Acid &c given with intent to act directly on the Albuminuria being of little avail. In the end our cases got better, and could be discharged, but whether they remained permanently free from the Symptom could not be ascertained.

Ward arrangements in Perth Inf.y

The arrangement of the wards in the Perth Infirmary has already been mentioned (See page 34) and reference may again be made to the Sketch of the ground plan of the Institution. The treatment of Infectious diseases in a General Infirmary is certainly not to be defended on any plea whatever, and negociations have long been in progress for the erection of a separate Fever Hospital for Perth and district in the outskirts of the town. Nevertheless, the isolation of our Scarlet Fever patients in wards separated by open passages from the rest of the Infirmary seemed to be sufficient to prevent the spread of the disease outside of its own quarter, as has already been pointed out (See page 33) The nursing Staff of course was quite distinct, their sleeping apartments being within the Fever House; but all the nurses mingled freely at meal & recreation times. While in the fever wards, and when touching the children, they wore white linen over-alls, which were kept strictly within the wards. In making my rounds as House Physician, I kept the Fever patients to the last, as far as possible; putting on overalls while in the wards, & carefully disinfecting

0. "Incubation period is very short, probably never exceeding a week,
"and rarely lasting so long." (Moore in Gibson's Textbook)

disinfecting my hands on retiring.

As there were four wards at the disposal of the fever patients, two (male & female) at each end of the Institution, an effort was generally made to separate acute from convalescent cases. This was, however, found impossible during the height of the epidemic, when all the resources of the available space were taxed to the utmost. The device of sending convalescents to a temporary hill hospital, and the great benefit derived therefrom, has been referred to. There being also a small open space adjoining the fever wards, to which sunshine and fresh air had free access, this was utilised as a playground for all of the children who were well enough to be outbye. Being quite shut off by long passages from the general section of the Infirmary, no danger ever arose from this source. It may be mentioned that at all available opportunities, that is to say, when the number of patients fell low enough to throw a ward vacant, the walls were washed down, the floors scrubbed, & the beds turned out; the windows being left wide open for several days. The necessity for frequent cleansing and disinfecting of fever wards cannot be too much insisted on.

Necessity for Observation Wards

The lack of a sufficient number of small isolation and observation wards was greatly felt in the Infirmary, especially during the height of the epidemic, when every room was filled up with cases. It frequently happened that patients were sent in whose symptoms were dubious, and for two reasons one was very reluctant to place them at once in the fever house. 1st. If the case were really not Scarlet fever the child was exposed to certain infection in the wards. It was unfortunately the case that more than once we were forced to believe that children thus took the disease from the other patients; the symptoms of Scarlet fever declaring themselves in one case eighteen days after admission, this strongly pointing to infection received in this way. 2nd. If the case turned out something else than Scarlet fever, our wards were exposed to danger from infection by this patient. We had

had a most unpleasant demonstration of this danger in the epidemic of measles already referred to, which arose from a Doctor having sent in a case of that disease in mistake for Scarlet Fever. Before it declared itself many of the children became infected, after which it spread like wildfire through the wards. Had we possessed the necessary accommodation, doubtful cases could have been watched for a week, to see what their real nature was. The advantage of having several isolation wards for the special treatment of very septic or malignant cases, and the absolute necessity of such for those complicated with Diphtheria, is obvious. All our cases of the latter nature, it should be added, were treated in separate wards by themselves.

Summary of Treatment

In conclusion it may be said that when we take a glance over the whole subject of treatment, the humiliating admission must be made, that while the great majority of simple cases get well of themselves, the bad cases seem to be beyond our power to influence. Nevertheless, when complications set in, the physician is generally able to lend a hand in the relief of pain and the cure of distressing symptoms. The treatment of Scarlet Fever, also, is not a discouraging task, when considered from the point of view of prophylaxis and hygiene. There is no doubt that isolation of cases in private or their removal to fever hospitals, the disinfection of clothes + sickrooms, improved methods of nursing, fresh air and Convalescent Homes during recovery, and such like measures, if effectually carried out, are of the greatest service in combatting the disease in a general sense. For the treatment of its manifestations in the individual we possess no specific drug, and we may at least be allowed to place our hopes in Serum Therapy, in the expectation that the Bacteriologist, when he at length discovers the microbe or the toxine of the disease, will be able also, as he has done in the case of Diphtheria, to provide us with its antidote.

Bibliography:—

Clifford Albutt. "A System of Medicine" 1896
Vol I. The General Pathology of Infection" Kanthack
Vol II Scarlet Fever. Caiger
Coexistence of Infectious Diseases. Caiger.
and other articles.

Bristowe. A System of Medicine. "Theory and Practice of Medicine" 1890.

Twentieth Century Practice. "Scarlet Fever" by Porchheimer. 1898

Real-Encyclopædie. Eulenburg. "Scharlach." by Finkelstein

Graves. Clinical Lectures on the Practice of Medicine 1864

Gairdner. Clinical Medicine 1862.

Deutsche Klinik am Eingange des Zwanzigsten Jahrhunderts. Band I &c. 1901.

Vierordt. Diagnostik der Innern Krankheiten. 1901

Quain. Dictionary of Medicine.

Gibson. Text Book of Medicine. 1901.

Ashby & Wright. Diseases of Children 1896.

Gerhardt. Lehrbuch der Kinderkrankheiten 1897.

Baginsky. do.— do.— 1892

Henoch. Vorlesungen über Kinderkrankheiten 1899

Oppenheim. Medical Diseases of Children 1900.

Goodall & Washbourne. A Manual of Infectious Diseases. 1896.

Muir & Ritchie - Manual of Bacteriology. 1897.

Newman. "Bacteria" 1899 (Progressive Science Series)

Klein. Micro-organisms & Disease.

Flügge. Micro-organisms. (Sydenham Society 1890)
Die Micro-organismen. 1896. 1897.

Lingenseen. Acute Exanthems 1896. "Nothnagel's Handbuch der Path. & Therapie." Band IV. Th III. Abt II.

Courtois. Streptococque & Scarlatine. Thesis. Paris. 1899.

Halatcheff. "Contribution a l'étude de la Scarlatine Maligné pseudo-diphterique". These. Geneva 1896

Friedrich. "Rhinologie Laryngologie und Otologie in ihren Bedeutung fur die allgemein Medicin" 1899.

British Medical Journal.

1887. 11 June. 30 July. 6 Aug. 20 Aug. 15 Oct. 17 Dec
1897. 25 Septem. 1898. 10 Sept.

Lancet. 1899. 18 Nov. 1900. 29 Sept.

Berliner Klinische Wochenschrift.

1895. Nos 23 et seq. 1900. 2 July. 9 July.

Zeitschrift für Hygiene & Infectionskrankheiten,

1900. Vol 34. p. 119 &

Journal of Hygiene. Vol 1. No 1.

Jahrbuch für Kinderheilkunde. Band 52

Treatment. May 1900.

Supplements to Local Government Reports for: —

1886. 1887 1894. 5.
1896. 7 1897. 8 1898. 9 1899. 00.

Report to Metropolitan Asylums Board on Return Cases of Scarlet Fever & Diphtheria 1901.

Appendix

Declaration

I hereby certify that the foregoing Thesis, entitled "A Study of some Clinical and Pathological Aspects of Scarlet Fever" has been composed solely by myself; my data having been derived from Notes of cases taken at the bedside by myself, while House Physician in the County & City of Perth Royal Infirmary, during 1897-98; and otherwise from independent research in British & Foreign Literature.

J Glendrell M.B. CM.

19th September 1901
(Thesis lodged)

Patients Name	III		IV		V		VI		VII	
McDougall	101·2	99·6	100·6	104·2	98·8	100·2	99·8	100·4	99·6	100·4
Veitch	102·0	102·8	101·6	102·6	100·4	102·2	101·8	103·0	102·6	102·6
Dewar	101·8	101·4	102·8	103·0	102·2	100·8	101·2	101·2	100·2	99·4
Archibald							101·6	101·8	99·2	100·8
Thomas			102·0	99·6	98·8	99·4	98·8	102·0	98·0	99·2
McLeod				103·6	103·0	102·0	102·0	103·0	101·8	101·0
Whitelock					102·2	101·4	99·2	100·0	98·6	98·2
Patterson								98·6	98·0	98·4
Aitken								103·0	101·6	102·4
King			102·6	102·8	103·4	102·6	100·6	101·0	101·6	101·0
Anderson							100·0	99·6	98·8	99·2
Stewart					103·2	102·2	100·0	101·0	98·6	101·6
McGregor	97·6	99·8	100·0	99·0	99·4	99·8	100·0	99·0	99·2	102·0
Raffen					101·4		100·6	101·0	101·0	100·0
McGregor	102·8	101·0	99·4	103·0	99·0	100·6	98·6	100·6	98·2	102·0
William	103·2	102·6	101·0	99·6	99·0	100·4	99·8	100·2	99·0	98·2
Johnston	101·0	101·6	99·6	103·0	99·8	103·0	99·4	103·6	99·6	102·6
Adamson	100·0	102·4	102·0	102·4	100·2	101·0	100·8	102·2	100·6	101·6
Anderson				101·4	99·8	100·8	100·0	99·0	100·4	100·4
Aitken	101·8	103·0	103·2	103·8	100·4	102·6	101·6	102·4	101·2	101·2
Nicholl †	101·8	102·0	102·2	101·4	101·2	101·2	101·0	103·0	101·2	103·0
Simpson				103·0	102·4	103·4	101·2	100·6	99·0	102·4
Lamb	100·0	102·4	100·6	100·2	99·2	99·8	99·0	98·4	98·4	98·6
Fisher				102·4	100·8	103·0	100·4	101·6	100·6	101·2
Galletly †								101·6	101·2	103·0
Anderson †	100·0	102·6	102·0	103·4	100·4	102·8	101·8	103·0	102·0	103·4
Hannah †						103·4	102·4	102·2	101·4	103·4
Campbell †					103·4	102·6	101·0	100·0	99·6	100·0
Cameron †	102·4	102·0	101·2	101·6	99·4	100·0	99·4	100·0	100·4	101·0
Brown †									101·8	101·0
Kerr.	101·2	102·0	101·2	100·8	99·0	99·8	98·4	99·4	98·0	99·0
	1418·8	1425·2	1624·0	2042·8	2416·8	2437·0	2710·4	3034·4	3101·4	3132·6
No of Records	14	14	16	20	24	24	27	30	31	31
Average	101·3	101·8	101·5	102·1	100·7	101·5	100·3	101·1	100·0	101·0

† Eventually Fatal.

Details of Temperature of 31 Cases of

VIII		IX		X		XI		XII	
98·4	98·8	97·6	98·8	97·4	97·8	97·4	99·2	97·8	102·0
102·4	103·4	102·0	102·0	101·0	102·0	100·8	103·0	100·0	102·2
98·8	100·0	100·4	99·4	100·0	98·6	100·0	100·0	99·0	102·6
99·0	99·2	98·6	100·4	99·6	102·0	99·4	101·4	99·4	100·4
100·0	100·0	99·6	100·6	98·0	101·0	99·0	99·4	98·0	98·0
101·8	102·8	103·4	103·8	102·6	103·2	101·8	101·6	100·4	99·0
99·2	100·4	98·8	99·0	98·8	99·8	98·6	99·0	97·4	99·0
98·0	99·2	101·8	102·6	100·4	102·6	100·8	102·6	99·0	101·4
100·2	102·4	99·8	101·6	100·4	101·0	100·4	99·0	98·6	98·6
100·6	103·2	102·2	101·2	100·6	101·0	99·6	100·0	98·4	99·4
98·8	97·6	98·8	99·4	98·0	98·2	97·6	98·0	98·0	99·4
100·0	101·4	98·0	102·2	98·0	101·4	99·0	102·6	99·0	101·0
101·2	102·6	100·4	102·2	99·6	99·8	98·0	98·2	97·2	99·0
98·2	99·8	98·0	100·2	98·0	101·2	100·6	102·2	99·6	101·6
98·0	102·6	99·0	102·8	99·2	102·2	98·2	100·4	98·2	101·4
99·0	100·0	98·6	99·4	98·6	100·4	99·0	99·4	98·2	102·2
100·0	101·8	100·4	100·4	99·0	100·8	97·6	98·4	97·6	98·8
101·8	103·6	101·6	101·6	101·0	102·4	99·8	102·0	99·8	101·0
99·0	102·8	101·0	101·6	101·4	101·8	101·0	101·6	101·0	101·6
99·8	101·0	99·8	101·8	100·2	102·4	101·8	101·0	100·2	101·0
100·6	102·8	100·6	102·4	101·0	102·0	101·0	102·2	100·8	103·0
101·8	103·0	100·0	101·4	99·0	100·6	102·4	103·8	103·4	102·8
98·0	98·6	97·8	99·2	98·0	99·0	97·4	99·4	98·0	99·2
98·6	100·8	99·2	100·0	99·0	101·0	98·8	98·6	97·8	97·8
102·2	103·6	102·0	103·0	102·0	103·0	102·0	102·0	103·0	102·8
102·2	103·4	102·2	102·8	102·2	102·0	101·6	101·6	101·4	103·0
102·6	103·2	102·2	100·6	101·2	106·2	103·4	103·8	103·6	103·8
99·0	100·2	101·2	105·0						
100·0	102·2	99·0	100·2	98·8	100·2	98·2	102·2	98·8	103·2
102·2	103·0	101·2	103·2	100·6	102·2	100·2	101·6	101·4	102·6
98·8	99·6	98·6	99·4	99·6	98·8	99·4	98·8	98·8	98 2
3100·2	3144·2	3103·8	3138·2	2993·2	3034·6	2996·8	3025·0	2983·8	3030·0
31	31	31	31	30	30	30	30	30	30
100·0	101·4	100·1	101·2	99·7	101·1	99·8	100·8	99·4	101·0

Septic Scarlet fever for 10 days.